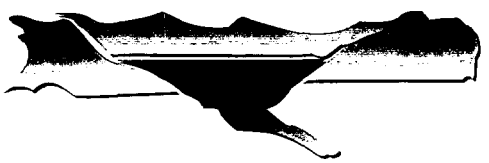
Request for Letter of Map Revision
Green Valley Area
Warm Springs Road and Green Valley Parkway
Clark County, Nevada

Prepared for:

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT
500 S. Grand Central Parkway
Las Vegas, NV 89155

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT



04-09-0954P

Prepared by:

PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074
(702) 263-7275

PBS&J

April 2, 2004

PBS&J

TABLE OF CONTENTS

APPENDICES

A. *FEMA Forms (Area's A – D) Separate Set for Each of Four Area's*

FEMA 'Overview and Concurrence Form' – MT-2 Form 1
FEMA 'Riverine Hydrology & Hydraulics Form' – MT-2 Form 2
Statement of Explanations

B. *Figures*

Figure 1 – Area/Vicinity Map
Figure 2 – CCRFCD Flood Control Facilities Map
Figure 2A – CCRFCD Flood Control Facilities Inventory
Figure 3 – FEMA Flood Zone Map
Figure 4 – FEMA Annotated Flood Zone Map

C. *Hydrology*

Rainfall Methodology and Soils Information
Area A HEC-1 Analysis & Figure A – Area A Drainage Map
Area B HEC-1 Analysis & Figure B – Area B Drainage Map
Area C HEC-1 Analysis & Figure C – Area C Drainage Map
Area D HEC-1 Analysis & Figure D – Area D Drainage Map

D. *Hydraulics*

Flow Master Street Capacity and Channel Cross-Sections
Area A Cross-Sections
Area B Cross-Sections
Area C Cross-Sections
Area D Cross-Sections

E. *Reference Material*

Area B - Civil Improvement Plans
UPRR Channel LOMR

F. *Data CD*

Electronic Hydrologic and Hydraulic Model files and Figures

1.0 INTRODUCTION

The purpose of this Letter of Map Revision (LOMR) is to address a needed revision of four remnant Zone A flood zones in the Green Valley area of Henderson, Nevada. The area in which the Zone A's are located is fully urbanized and characterized by mixed density residential, a golf course and commercial developments. The majority of the project area was developed between the mid 1980's and early 1990's. Note that technical drainage studies and/or civil improvement plans for many of the developments were not readily available from the local entity due to the age of the project area. Remnant flood zones, such as these, are generally created as a result of LOMR's not being pursued after developments or flood control facilities have been constructed. The historic flood source to the area of concern has been substantially reduced based on urbanization and the implementation of flood control facilities. In particular is the Union Pacific Rail Road (UPRR) Channel that runs along the southern side of the UPRR right-of-way. The channel consists of a concrete trapezoidal section, 10' wide, 5' deep with 2H:1V side slopes that conveys flow easterly and away from the project area. A LOMR for this channel was approved by FEMA in 1993 and subsequently in 1994 for an additional segment of the channel east of the project site. A copy of the LOMR's can be found in Appendix E. As a result of flow reduction to the project area this LOMR request will analyze four individual Zone A flood zones and demonstrate that the current conditions no longer warrant the flood zone delineation for three of the areas and revision to the floodzone for the fourth as shown on the current effective FIRM Panels (2580, 2590), & 2583) dated September 27, 2002, revised to reflect LOMR dated August 13, 2003. Note that the LOMR dated August 13, 2003 does not affect the project area. The flood zones of interest have been labeled Area A, Area B, Area C, and Area D for ease of identification when discussing the flood zones throughout the report. Please refer to **Figure 1 Area/Vicinity Map** for an overall view of the project area. Also refer to **Figure 2 CCRFCD Flood Control Facilities Map** that shows existing and proposed facilities within and adjacent to the project area.

2.0 AREA DESCRIPTIONS

The following is a description of the four individual flood zones being requested for removal from the current FIRM Panels.

2.1 AREA A DESCRIPTION

Area A is the smallest of the zones and has an aerial extent of approximately 1.8 acres and is roughly 500 feet long and 200 feet wide. Area A is located within Community FIRM Panel Number 32003C2580E dated September 27, 2002, revised to reflect LOMR dated August 13, 2003. Area A is bordered on the

upstream end by the UPRR rail and extends northeast through single-family residential and terminates at the western boundary of an apartment complex. An existing storm drain (42" RCP) traverses Area A from southwest to northeast and collects flow from a small portion of the UPPR ROW and the residential area as shown on **Figure A – Area A Drainage Basin Map**. The limits of this flood zone are also shown on the FEMA Flood Zone Map (see **Figure 3**).

2.2 AREA B DESCRIPTION

Area B has an aerial extent of approximately 11.8 acres and is roughly 3,000 feet long and 200 feet wide. Area B is located within Community FIRM Panel Number 32003C2580E dated September 27, 2002, revised to reflect LOMR dated August 13, 2003. Area B is bordered on the upstream end by an existing apartment complex. Area B then extends northeast through a commercial complex, the intersection of Warm Springs and Green Valley Parkway, another apartment complex and terminates on an existing golf course. The previously mentioned 42" RCP that originates in Area A daylights onto the golf course within the delineated floodzone of Area B as shown on **Figure B – Area B Drainage Basin Map**. The limits of this flood zone are also shown on the FEMA Flood Zone Map (see **Figure 3**).

2.3 AREA C DESCRIPTION

Area D has an aerial extent of approximately 5.6 acres and is roughly 1,500 feet long and 200' wide. Area D is located within Community FIRM Panel Number 32003C2580E dated September 27, 2002, revised to reflect LOMR dated August 13, 2003. Area D is bordered on the downstream end by Valle Verde and extends northeast through a park and single-family residential. Area D terminates within the right-of-way of Fox Ridge Drive as shown on **Figure D – Area D Drainage Basin Map**. The limits of this flood zone are also shown on the FEMA Flood Zone Map (see **Figure 3**).

2.4 AREA D DESCRIPTION

Area D is a large remnant floodzone finger that extends for approximately 4,000 feet in a northeasterly direction (see **Figure 1**). However, for the purpose of this analysis, only the upstream portion of the finger covering four residential lots through Sunset Road is considered. Area D is located within Community FIRM Panel Number 32003C2580E dated September 27, 2002, revised to reflect LOMR dated August 13, 2003. Area D is within existing single-family and multi-family residential as shown on **Figure D – Area D Drainage Basin Map**. The limits of this flood zone are also shown on the FEMA Flood Zone Map (see **Figure 3**).

3.0 HYDROLOGIC & HYDRAULIC MODELING

The hydrologic model utilized to calculate runoff is the HEC-1 Flood Hydrograph Package, Version 4.1, developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center. The methodology and calculations used to determine the hydrologic parameters in the HEC-1 modeling are included in Appendix C. The local parameters for computing runoff have been developed in accordance with the Clark County Regional Flood Control District's Hydrologic Criteria and Drainage Design Manual.

FlowMaster, version 6.1 was used for velocity estimation calculations in the hydrologic modeling. Also, Flowmaster was used for street hydraulics and depth calculations. Note: although the hydrologic models include a 10-year/100-year analysis, flows discussed in the following sections are for the 100-year event only.

3.1 AREA A ANALYSIS

Area A has been subdivided into two basins (EX1A and EX2A) that contribute flow to the flood zone. Basin EX1A (18 cfs) is 7.8 acres and consists of single-family residential and one interior street. Basin EX2A (7 cfs) is 5.7 acres and consists of vacant land within the UPRR right-of-way. Basins EX1A and EX2A combine at combination point C1 for a total 100-year flow of 25 cfs. Flow at C1 is collected by an existing 42" RCP. An inlet control nomograph for the 42" RCP was performed to show sufficient capacity for the flow of 25 cfs. The calculation shows 2.03' of head is produced from 25 cfs, which is less than the diameter of the pipe (3.5'). The inlet control calculation can be found in Appendix D for Area A. Two cross-sections have been cut for each basin to establish the depth of flow. Please refer to **Figure A Area A Drainage Map** for the location of the cross-sections. Cross-section A-A is located in the 40' right-of-way of the interior street of basin EX1A and shows a depth of 0.36' feet. Cross-section B-B is within the swale of the UPRR right-of way and shows a depth of 0.09' feet. These cross-sections demonstrate that the depth of flow is less than 1-foot and the drainage area is less than one square mile, thus Area A warrants exclusion from the FIRM panel. Please refer to Appendix D for the Flowmaster cross-section worksheets.

3.2 AREA B ANALYSIS

Area B has been subdivided into eight basins (EX1B through EX8B) that contribute flow to the flood zone. Please refer to **Figure B Area B Drainage Map** for a complete summary of flows and basin delineations. Basin EX1B (108

cfs) is 54.8 acres and consists of single-family residential and the full 100' right-of-way of Warm Springs Road. Flow from basin EX1B drains to Warm Springs Road and is then conveyed east towards the intersection with Green Valley Parkway. Basin EX2B (22 cfs) is 9.3 acres and consists of an existing apartment complex. Flow from basin EX2B is captured by an existing 8-foot sump condition drop inlet and drains to the previously mentioned 42" RCP from Area A. Information regarding the apartment hydrology and drop inlet could not be readily obtained; therefore, PBS&J performed a drop inlet calculation assuming reasonable parameters. The HY-22 drop inlet calculation can be found in Appendix D and shows the entire flow can be captured with minimal ponding. Basin EX3B (6 cfs) is 2.3 acres and consists of the remainder of the apartment complex and drains northeast to an existing commercial complex. Note that the apartment basins were delineated based on a field investigation of the site as plans were not readily available. Basin EX4B (32 cfs) is 11.4 acres and consists of a commercial complex. Flow from basin EX4B combines with flow from basin EX3B and is captured by two existing 8-foot sump condition drop inlets and drains to the 42" RCP. Again, HY-22 drop inlet calculations were performed and show the entire flow could be captured with minimal ponding. Basin EX5B (13 cfs) is 4.7 acres and consists of the remainder of the commercial complex. Flow from basin EX5B drains to Green Valley Parkway. Basin EX6B (11 cfs) is 3.5 acres and consists of the full 100' right-of-way of Green Valley Parkway. Flow from basin EX5B and EX6B combine for 24 cfs and is conveyed north in Green Valley Parkway towards the intersection with Warm Springs Road. Basin EX7B (48 cfs) is 19.3 acres and consists of an apartment complex. Basin EX7B is conveyed northwest through the basin and drains to an existing golf course. Please refer to Appendix E for the civil improvement plans for "The Crossings" apartment complex. The plans show limited information on the storm drain and drop inlets. Basin EX8B (22 cfs) is 17.7 acres and consists of an existing golf course. Basin EX8B is conveyed northwest through the golf course. Basins EX7B, EX8B and the discharge from the 42" RCP (including Area A) combine for 149-cfs at combination point C2 as shown on Figure B. Four cross-sections have been cut to establish the depth of flow in Warm Springs Road and Green Valley Parkway. One additional cross-section has been cut at the downstream end of basin EX8B to demonstrate the flow depth in the golf course. Cross-section A-A is in the right-of-way of Green Valley Parkway and shows a depth of flow of 0.56 feet. The flow at section A-A is 24 cfs and consists of basin EX5B and EX6B. Note that flow at cross-section B-B has been analyzed under two different scenarios as described below. Cross-section B-B is located in the 100' right-of-way of Warm Springs Road. The first scenario for cross section B-B assumes all the flow from basin EX1B is conveyed east across the intersection with Green Valley Parkway. Also, it is assumed the 24 cfs in Green Valley Parkway does not flow split and all turns east onto Warm Springs for a total 100-year flow of 132 cfs. This is considered the worst case for cross section B-B and shows a flow depth of 0.81 feet. The second scenario for section B-B assumes a flow split for basin EX1B. The flow split analysis shows 29-cfs diverting north in

Green Valley Parkway and 79-cfs remaining east in Warm Springs. A second flow split occurs for the 24 cfs in Green Valley Parkway that shows 8-cfs diverting onto Warm Springs and 16-cfs remaining in Green Valley Parkway. This scenario produces a 100-year flow of 87 cfs at section B-B and shows a flow depth of 0.72 feet in Warm Springs Road. In either case the depth of flow at cross section B-B is less than 1-foot. Also note that a cross section shows the capacity of Warm Springs Road at 1-foot of depth is 280 cfs. The analysis shows that flow in Warm Springs is significantly less. A street capacity calculation for 108 cfs at cross section C-C shows a flow depth of 0.76 feet for basin EX1B. As with cross section B-B, flow at section D-D has been analyzed under two different scenarios as described below. Cross-section D-D is located in the 100' right-of-way of Green Valley Parkway. Note that a cross section shows the capacity of Green Valley Parkway at 1-foot of depth is 185 cfs. The first scenario for cross section D-D assumes all the flow (24 cfs) from basins EX5B and EX6B is conveyed north across the intersection with Warm Springs Road. This flow combines with the 29 cfs from the Warm Springs flow split for a total 100-year flow of 53 cfs. This is considered the worst case for cross section D-D and shows a flow depth of 0.69 feet. The second scenario for section D-D assumes a flow split occurs in Warm Springs and Green Valley Parkway as previously described. This scenario produces a 100-year flow of 45 cfs at section D-D and shows a flow depth of 0.66 feet in Green Valley Parkway. In either case the depth of flow at cross section D-D is less than 1-foot. Flow at cross section E-E (149-cfs) shows a flow depth of 0.26 feet.

Please refer to Appendix D for the flow split calculation worksheets and the Flowmaster street depth calculations. These cross-sections demonstrate that the depth of flow is less than 1-foot at all locations analyzed. Also the drainage area is less than one square mile thus Area B warrants exclusion from the FIRM panel.

3.3 AREA C ANALYSIS

Area C consists of one basin EX1C that contributes flow to the subject floodzone. Basin EX1C (53 cfs) is 22.3 acres and consists primarily of single-family residential and a portion of a public park. Flow from basin EX1C concentrates at the location of cross-section A-A and discharges to the Fox Ridge Drive right-of-way. Cross-section A-A is located in the 40' right-of-way of the interior street of basin EX1C and shows a depth of 0.54' feet. Please refer to Appendix D for the Flowmaster cross sections. The cross-section demonstrates that the depth of flow is less than 1-foot and the drainage area is less than one square mile, thus Area C warrants exclusion from the FIRM panel.

3.4 AREA D ANALYSIS

Area D has been subdivided into seven basins (EX1D through EX7D) that contribute flow to the subject floodzone. Basin EX1D (30 cfs) is 16.5 acres and consists of single-family residential. Basin EX5D (58 cfs) is 24 acres and consists of single-family residential, commercial, and a park. Basin EX6D (21 cfs) is 7 acres and consists of fully developed commercial. Flow from basins EX1D, EX5D and EX6D is conveyed through the surface streets and drain to Fox Ridge. A portion of the flow from these basins drain to EX2D and the remainder drains to EX3D. Basin EX2D (30 cfs) is 12.8 acres and consists of single-family residential. Basin EX3D (29 cfs) is 12.3 acres and consists of single-family residential. Basin EX4D (53 cfs) is 22.3 acres and consists of single family residential. Flow from basins EX2D, EX3D and EX4D combine with basins EX1D, EX5D and EX6D for a total 100-year flow of 221 cfs at combination point C2 as shown on Figure D. A Flowmaster section at B-B shows a depth in the street of 0.87 feet using the flow of 221 cfs. The cross-section demonstrates that the depth of flow is less than 1-foot and the drainage area is less than one square mile, thus Area D warrants exclusion from the FIRM panel. The portion of the flood zone proposed for removal is shown on Figure D1.

Flow at C2 is then conveyed between the residential lots in a drainage easement consisting of a 5-foot wide concrete lined channel and transitions to a stair-stepped channel on the steep landscaped slope behind the residential lots. The channel discharges to a 6' x 6' x 4.5' concrete sump box. The sump has an 18" outlet pipe that conveys a small portion of the flow beneath the apartment complex and daylights on the north side of Sunset Road. An inlet control nomograph calculation shows the 18" RCP outlet pipe has a capacity of 15 cfs with the available head of 3 feet. The remainder of the flow would weir out of the box and discharge onto the parking lot of the apartment complex and combine with the 25 cfs from the apartment complex basin (EX7D). The total surface flow in the apartment complex is (221 cfs – 15 cfs + 25 cfs) = 231 cfs. The 231 cfs would surface drain through the parking area/interior drive of the apartment complex and ultimately impact the two buildings located just north of the drive entrance along the eastern boundary of the complex. Three normal depth cross-sections (D-D, E-E, and F-F) demonstrate that the flow depth in the parking/driveway of the apartment complex is less than 1 foot (see Appendix D). A field visit to the apartment complex revealed the structures are a minimum of 18" above the top of curb from where the normal depth cross-sections are and thus the buildings are sufficiently protected. Flow exiting the apartment complex would drain to Sunset Road where it would be conveyed easterly. Based on the above information and supporting calculations, PBS&J has proposed a floodzone revision starting from the 5-foot drainage easement, through the apartment complex and within a portion of Sunset Road. The proposed flood zone revision would tie-in to the existing flood zone in Sunset Road as shown on Figure D1.

4.0 CONCLUSION

We believe that based on the data and supporting calculations contained within this Letter of Map Revision application, the requested revision to the four subject Flood Zone A's is warranted. Please refer to **Figures 3 and 4, FEMA Flood Zone Map and Annotated FEMA Flood Zone Map**. Figure 3 shows the four remnant flood zones entirely removed from the current FIRM panels.

5.0 REFERENCES

Criteria Manual — *Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual.* Prepared for: Clark County Regional Flood Control District. Adopted August 12, 1999.

FlowMaster — FlowMaster Version 6.1, Haestad Methods, Inc. 1999.

HEC-1 — HEC-1 Flood Hydrograph Package Version 4.0. U.S. Army Corps of Engineers, Hydrologic Engineering Center, September 1990.

MPU 02 — *CCRFCD Master Plan Update of the Las Vegas Valley 2002.* Prepared for Clark County Regional Flood Control District. Prepared by PBS&J , 2002.

SCS — *Soil Survey of Las Vegas Valley Area Nevada 1985.* United States Department of Agriculture, Soil Conservation Service.

APPENDIX A

FEMA MT-2 Forms

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

☐ CLOMR: A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See Parts 60 & 65 of the NFIP Regulations.)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
320003	Clark County Unincorporated Areas	NV	32003C	2590E	08/13/03
320005	City of Henderson	NV	32003C	2580E	08/13/03

2. Flooding Source: Urban Runoff

3. Project Name/Identifier: UPRR FIS

4. FEMA zone designations affected: A (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

☒ Physical Change ☒ Improved Methodology/Data

☐ Regulatory Floodway Revision ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following types of flooding and structures (check all that apply)

Types of Flooding:	☐ Riverine	☐ Coastal	☐ Shallow Flooding (e.g., Zones AO and AH)
	☐ Alluvial fan	☐ Lakes	☒ Other (Attach Description)
Structures:	☐ Channelization	☐ Levee/Floodwall	☐ Bridge/Culvert
	☐ Dam	☐ Fill	☐ Other, Attach Description

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☒ Yes Fee amount: $4,200

☐ No, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/fhm/frm_fees.shtm **for Fee Amounts and Exemptions.**

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Stephen C. Altman, P.E., CFM	Company: PBS&J	
Mailing Address: 2270 Corporate Circle Suite 100 Henderson, NV 89074	Daytime Telephone No.: (702) 263-7275	Fax No.: (702) 263-7200
	E-Mail Address: saltman@pbsj.com	
Signature of Requester (required):		Date: April 2, 2004

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Curt Chandler, P.E., Land Development Manager, Public Works		Telephone No.: (702) 565-2329
Community Name: City of Henderson CURT CHANDLER	Community Official's Signature (required): Submitted copy signed	Date: April 2, 2004

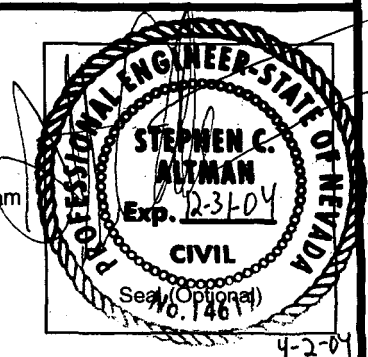
CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Stephen C. Altman, P.E., CFM	License No.: NV 14617	Expiration Date: 12/31/04
Company Name: PBS&J	Telephone No.: (702) 263-7275	Fax No.: (702) 263-7200
Signature:		Date: April 2, 2004

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans



FEMA FORMS

Area A

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Urban Runoff
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☐ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☒ Changed physical condition of watershed

2. *Comparison of Representative 1%-Annual-Chance Discharges*

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Warm Springs @ Green VP	0.0211	na	25

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1 [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit				
Upstream Limit				

2. Hydraulic Method Used

Hydraulic Analysis Flow Master 6.1 [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☐ Yes ☒ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name:	Floodway File Name:
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

FEMA FORMS

Area B

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Urban Runoff
Note: *Fill out one form for each flooding source studied*

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☐ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☒ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Warm Springs @ Green VP	0.1922	na	262

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1 [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No *If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.*

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Water-Surface Elevations (ft.) Proposed/Revised
Downstream Limit				
Upstream Limit				

2. Hydraulic Method Used

Hydraulic Analysis Flow Master 6.1 [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/fhm/frm_soft.shtm. *We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.* If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☐ Yes ☒ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name:	Floodway File Name:
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

C. MAPPING REQUIREMENTS

A **certified topographic map** *must be submitted showing the following information (where applicable):* the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the *effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.*

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

FEMA FORMS

Area C

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Urban Runoff
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☐ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☒ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Warm Springs@Valle Verde	0.0348	na	53

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1 [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Water-Surface Elevations (ft.) Proposed/Revised
Downstream Limit				
Upstream Limit				

2. Hydraulic Method Used

Hydraulic Analysis Flow Master 6.1 [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☐ Yes ☒ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name:	Floodway File Name:
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

FEMA FORMS

Area D

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Urban Runoff
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☐ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☒ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Warm Springs@Valle Verde	0.0395	na	231

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1 [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Water-Surface Elevations (ft.) Proposed/Revised
Downstream Limit				
Upstream Limit				

2. Hydraulic Method Used

Hydraulic Analysis Flow Master 6.1 [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☐ Yes ☒ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name:	Floodway File Name:
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

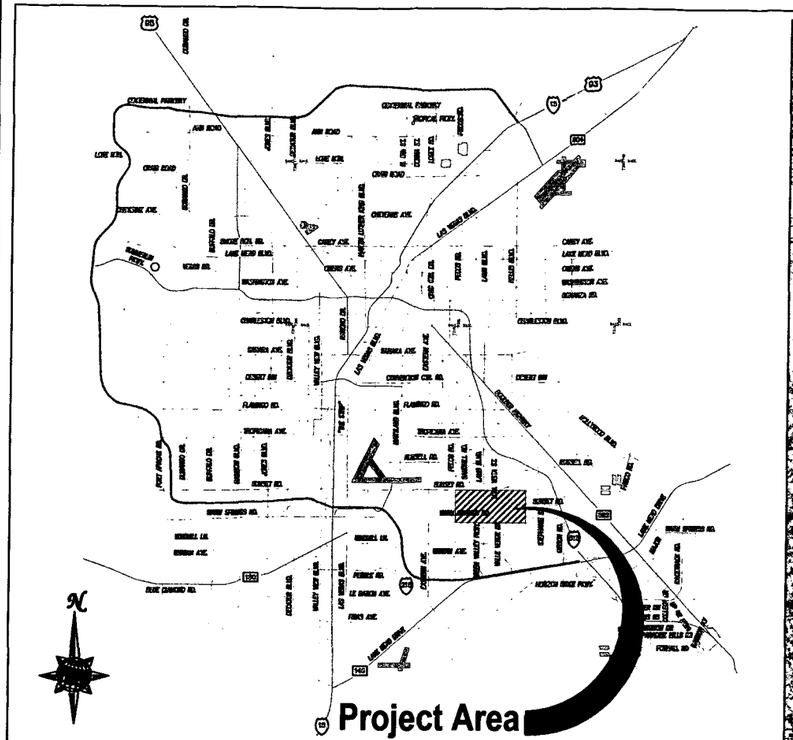
EXPLANATIONS

MT-2 Form 1 Section B, 5b.

Types of Flooding: Flooding type is characterized by fully urbanized runoff consisting of residential and commercial. Flow is primarily contained and conveyed within private and public right-of-ways.

APPENDIX B

Figures



GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)

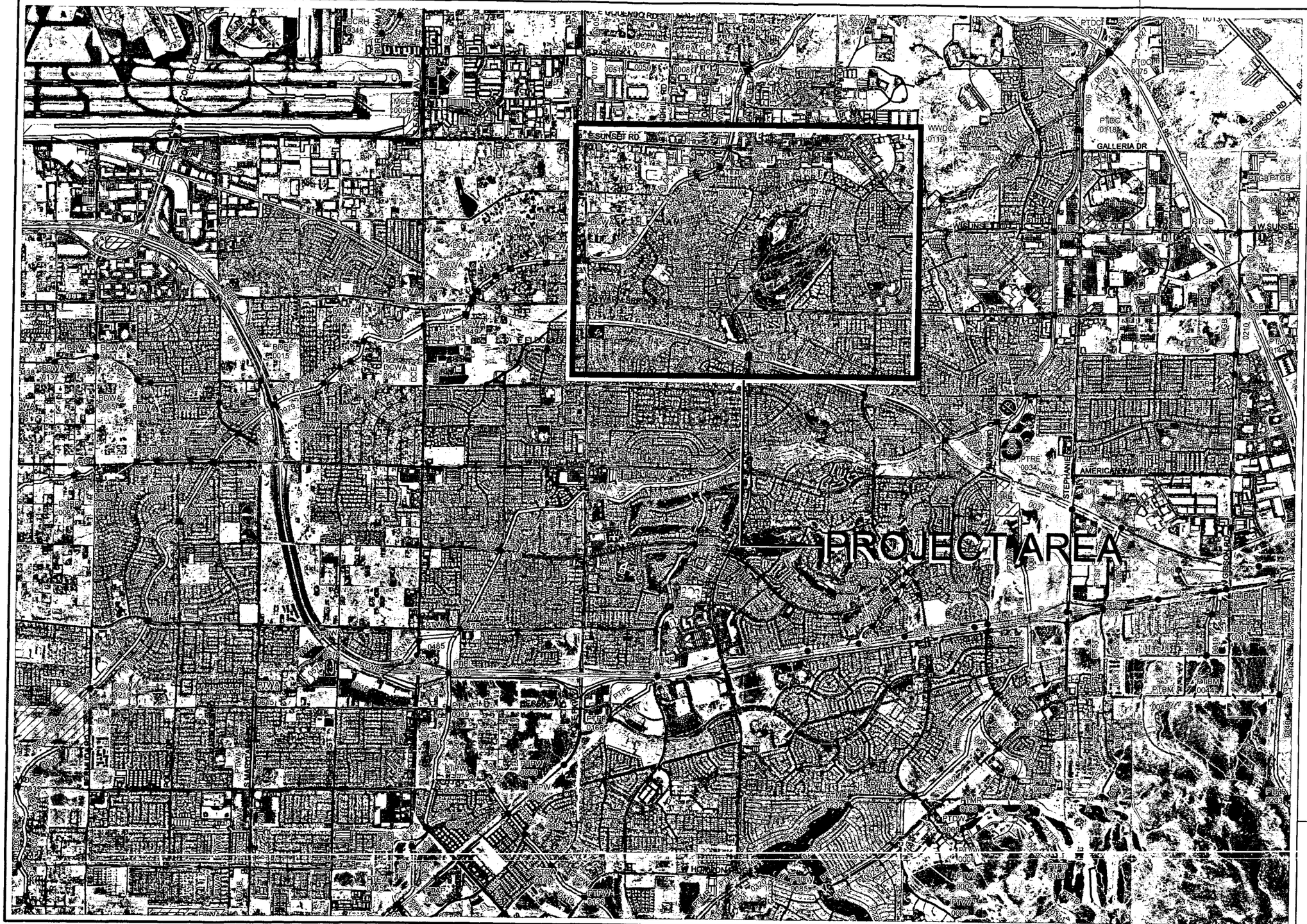
1 inch = 1000 ft.

FIGURE 1: AREA/VICINITY MAP

Floodzone

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE 1



REGIONAL FLOOD CONTROL DISTRICT

2002 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Culvert
- Bridge
- Pipeline
- Lined Channel
- Unlined Channel
- Dike
- Natural Wash
- ID-Mile Separator

N W E S

0 1,000 2,000 3,000 4,000 5,000 Feet

SCALE: 1 inch = 3000 feet

US95 I-15 I-215

FLOOD CONTROL FACILITIES
FIGURE F-21

PBS&J

C.C. WALLACE, INC.

FIGURE 2

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BDBE		**BLUE DIAMOND AT BELTWAY**						
0000	E	Conc Chnl 20'W 6'D 2:1 SS	860	969	CDCC140	DUCK3	3.70	0.77
0015	E	2: 10' X 4' RCBC @ Robindale	140	969	CDCC140	DUCK3	3.70	0.60
0018	E	Conc Chnl 20'W 6'D 2:1 SS	2760	969	CDCC140	DUCK3	3.70	0.77
0068	E	2: 7' X 3' RCBC @ Paradise/Warm Springs	350	785	CDCC135	DUCK3	3.35	0.77
0074	E	Conc Chnl 15'W 3'D 2:1 SS	510	565	CDCC135N	DUCK3	2.96	0.77
0084	E	10' X 4' RCB	1050	565	CDCC135N	DUCK3	2.96	0.77
0104	E	Conc Chnl 10'W 3'D 2:1 SS	1430	518	CDCACDB	DUCK3	2.76	0.77
0134	E	2: 60" RCP @ Airport Connector	290	518	CDCACDB	DUCK3	2.76	1.48
BDWA		**BLUE DIAMOND WASH**						
0000	E	Conc Chnl 20'W 6'D 0:1 SS	1520	1331	CDCC070W	DUCK3	2.52	1.00
0030	E	3: 10' X 5.5' RCBC @ Paradise	150	1331	CDCC070W	DUCK3	2.52	1.30
0031	E	Conc Chnl 10'W 8'D 0-1:1 SS	2725	1331	CDCC070W	DUCK3	2.52	0.63
0059	E	3: 8' X 4' RCBC @ Robindale	150	1331	CDCC070W	DUCK3	2.52	1.40
0060	E	Conc Chnl 20'W 8'D 0:1 SS	380	1331	CDCC070W	DUCK3	2.52	2.72
0085	E	2: 10' X 4' RCBC @ Amigo	50	1073	CBUB310	DUCK3	2.12	1.80
0086	E	Natural Wash	1570	1073	CBUB310	DUCK3	2.12	
0086	P1	10' X 5' RCB	1570	1073	CBUB310	DUCK3	2.12	3.00
0111	E	36" CMP @ Bermuda	50	1073	CBUB310	DUCK3	2.12	1.60
0111	P1	Replace with 10' X 6' RCB	50	1073	CBUB310	DUCK3	2.12	1.60
0112	E	Natural Wash	1310	1073	CBUB310	DUCK3	2.12	
0112	P1	10' X 5' RCB	1310	1073	CBUB310	DUCK3	2.12	3.00
0137	E	24", 36", and 54" CMP @ Placid	50	1073	CBUB310	DUCK3	2.12	1.40
0137	P1	Replace with 10' X 6' RCB	50	1073	CBUB310	DUCK3	2.12	1.40
0138	E	Natural Wash	1880	881	CBUB300	DUCK3	1.64	
0138	P1	10' X 5' RCB	1880	881	CBUB300	DUCK3	1.64	2.50
DCBD		**DUCK CREEK / BLUE DIAMOND**						
0000	E	Conc Chnl 10'W 5'D 1.6:1 SS	770	1976	CBUB360W	DUCK4	11.11	1.73
0016	E	Single Span Bridge 26'W 8.5'D @ Vision	60	1976	CBUB360W	DUCK4	11.11	2.10
0017	E	Conc Chnl 10'W 5'D 1.6:1 SS	1015	1976	CBUB360W	DUCK4	11.11	1.73
0032	E	Single Span Bridge 26'W 8.5'D @ Vista Twilight	40	1976	CBUB360W	DUCK4	11.11	1.80
0033	E	Conc Chnl 10'W 5'D 1.6:1 SS	615	1976	CBUB360W	DUCK4	11.11	1.73
0046	E	Single Span Bridge 26'W 8.5'D @ Amigo	50	1976	CBUB360W	DUCK4	11.11	2.20
0047	E	12' X 10' RCB	1160	1976	CBUB360W	DUCK4	11.11	2.50
0065	E	1: 12' X 10' RCBC @ Bermuda	310	1892	CBUB350	DUCK4	10.85	2.23
0073	E	Natural Wash	630	1892	CBUB350	DUCK4	10.85	
0073	P1	Conc Chnl 25'W 5'D 2:1 SS	630	1892	CBUB350	DUCK4	10.85	1.40
0082	E	4: 48" RCP @ Fairfield	80	1892	CBUB350	DUCK4	10.85	1.10
0082	P0	Replace with 2: 14' X 6' RCBC @ Fairfield	80	1892	CBUB350	DUCK4	10.85	1.10
0083	E	Natural Wash	4750	1892	CBUB350	DUCK4	10.85	
0083	P1	Conc Chnl 20'W 5.5'D 2:1 SS	4750	1892	CBUB350	DUCK4	10.85	1.10
DCEA		**DUCK CREEK - EASTERN BRANCH**						
0000	P1	1: 8' X 5' RCB	2000	645	CDCC280S	DUCK3	1.01	1.50
DCGL		**DUCK CREEK GILESPIE CHANNEL**						
0000	E	Natural Wash	1900	1811	CDLD460	DUCK3	2.56	
0000	P2	Conc Chnl 32'W 6'D 0:1 SS	1900	1811	CDLD460	DUCK3	2.56	0.80
0035	P2	2: 16' X 4' RCBC @ Silverado Ranch	60	1811	CDLD460	DUCK3	2.56	0.90
0036	E	Natural Wash	1111	1811	CDLD460	DUCK3	2.56	
0036	P1	Conc Chnl 35'W 4'D 0:1 SS	1111	1811	CDLD460	DUCK3	2.56	0.80
0057	E	Conc Chnl 32'W 9.0'D 3:1 SS	1580	841	CDLD460S	DUCK3	1.10	0.20
0086	E	4: 8' X 5' RCBC @ E Pyle Ave	60	841	CDLD460S	DUCK3	1.10	1.20
0087	E	Natural Wash	1080	841	CDLD460S	DUCK3	1.10	
0087	P1	Conc Chnl 32'W 3.5'D 3:1 SS	1080	841	CDLD460S	DUCK3	1.10	0.90
0106	E	3: 8' X 4' RCBC @ La Cienega	80	841	CDLD460S	DUCK3	1.10	0.50
0107	E	Conc Chnl 12'W 7'D 2:1 SS	310	567	CDLD450	DUCK3	0.75	1.30
0112	E	2: 10' X 4' RCBC @ E Frias Ave	60	567	CDLD450	DUCK3	0.75	0.50
0113	E	Conc Chnl 12'W 7'D 2:1 SS	490	567	CDLD450	DUCK3	0.75	2.40
DCPA		**DUCK CREEK - PATRICK COLLECTOR**						
0000	E	Parallel 78" & 66" RCP	450	1333	CDCC340W	DUCK3	1.57	1.50
0001	P0	Add 1: 66" RCP	450	1333	CDCC340W	DUCK3	1.57	1.50
0008	P0	Add 1: 11' X 6' RCB	2210	1333	CDCC340W	DUCK3	1.57	1.00
0009	E	Parallel 54" & 66" RCP	2210	1333	CDCC340W	DUCK3	1.57	1.00
0050	P0	Add 1: 14' X 5' RCB	2860	1333	CDCC340W	DUCK3	1.57	0.80
0051	E	66" RCP	2860	1333	CDCC340W	DUCK3	1.57	0.80
0104	P0	Add 1: 6' X 5' RCB	2650	406	DCC370	DUCK3	0.53	0.40
0105	E	60" RCP	2650	406	DCC370	DUCK3	0.53	0.40
0106	E	48" RCP	1360	449	DCC330	DUCK3	0.51	0.50
0107	P0	Add 1: 9' X 4' RCB	1360	449	DCC330	DUCK3	0.51	0.50
DCPI		**DUCK CREEK PINE STREET**						
0000	E	1: 12' X 4' RCB	1360	785	CDCC310S	DUCK3	1.21	0.60
DCRH		**DUCK CREEK - RAWHIDE CHANNEL**						
0306	E	Earth Chnl 15'W 4.6'D 1:1 SS	1090	535	CDMC060	DUCK3SC	0.60	0.70
0306	P1	Conc Chnl 12'W 4.5'D 1.5:1 SS	1090	535	CDMC060	DUCK3SC	0.60	0.70
0329	E	2: 36" RCP @ Oquendo Rd	60	535	CDMC060	DUCK3SC	0.60	0.60
0329	P0	Replace with 3: 7' X 5' RCBC @ Oquendo Rd	60	535	CDMC060	DUCK3SC	0.60	0.60
0330	E	Earth Chnl 4.6'D 15'W 1:1 SS	860	535	CDMC060	DUCK3SC	0.60	0.70
0330	P1	Conc Chnl 12'W 4.5'D 1.5:1 SS	860	535	CDMC060	DUCK3SC	0.60	0.70
0346	E	3: 18" RCP @ Burnham Rd	60	535	CDMC060	DUCK3SC	0.60	0.60
0346	P0	Repalce with 1: 10' X 7' RCBC @ Burnham Rd	60	535	CDMC060	DUCK3SC	0.60	0.60
DCSP		**DUCK CREEK - SUNSET PARK**						
0000	P1	1: 11' X 6' RCB	8200	784	CDCC230	DUCK3	1.47	0.70
DCWA		**DUCK CREEK WASH**						
0520	E	Natural Wash	3660	5826	CDCC360	DUCK5SC	21.47	
0520	P1	Gabion Chnl 75'W 6.5'D 2:1 SS	3660	5826	CDCC360	DUCK5SC	21.47	1.80
0580	P1	Conc Chnl 50'W 6.5'D 2:1 SS	230	5743	CDCC190*	DUCK5SC	19.15	0.76
0594	E	2 Span Bridge 130'W 15'D @ GVP/Patrick	70	5743	CDCC190*	DUCK5SC	19.15	1.40
0597	E	Natural Wash	2500	5743	CDCC190*	DUCK5SC	19.15	
0597	P1	Gabion Chnl 65'W 7'D 2:1 SS	2500	5743	CDCC190*	DUCK5SC	19.15	1.60
0646	E	3 Span Bridge 45'W 15'D @ Sunset	100	5743	CDCC190	DUCK5SC	19.15	1.70
0647	E	Earth Chnl 50'W 15'D 2:1 SS	600	5743	CDCC190	DUCK5SC	19.15	1.00
0647	P1	Conc Chnl 50'W 6.5'D 2:1 SS	600	5743	CDCC190	DUCK5SC	19.15	1.00
0654	E	Free Span Bridge 40'W 15'D 3:1 SS	50	5743	CDCC190	DUCK5SC	19.15	1.00
0655	E	Earth Chnl 50'W 15'D 2:1 SS	790	5743	CDCC190	DUCK5SC	19.15	0.60
0655	P1	Conc Chnl 50'W 7.5'D 2:1 SS	790	5743	CDCC190	DUCK5SC	19.15	0.60
0668	E	Free Span Bridge 40'W 15'D 3:1 SS @ Sunfire	40	5743	CDCC190	DUCK5SC	19.15	1.00
0669	E	Natural Wash	1120	5743	CDCC190	DUCK5SC	19.15	
0669	P1	Conc Chnl 28'W 8'D 2:1 SS	1120	5743	CDCC190	DUCK5SC	19.15	1.29
0695	E	Drop Structure		5416	CDCC240	DUCK5SC	17.96	
0696	E	Conc Chnl 28'W 8'D 2:1 SS	150	5416	CDCC240	DUCK5SC	17.96	1.29
0698	E	Drop Structure		5416	CDCC240	DUCK5SC	17.96	
0699	E	Conc Chnl 28'W 8'D 2:1 SS	150	5416	CDCC240	DUCK5SC	17.96	1.29
0701	E	Drop Structure		4982	CDCC240S	DUCK5SC	16.49	
0702	E	Conc Chnl 28'W 8'D 2:1 SS	3340	4982	CDCC240S	DUCK5SC	16.49	1.20
0762	E	Single Span Bridge 42'W 8'D @ Pecos	100	4923	CDCC310	DUCK5SC	16.09	1.10
0763	E	Earth/Conc Chnl 32'W 8'D 0:1 SS	220	4923	CDCC310	DUCK5SC	16.09	1.10
0763	P1	Conc Chnl 32'W 8'D 0:1 SS	220	4923	CDCC310	DUCK5SC	16.09	1.10
0767	E	2 Span Bridge 32'W 7.0'D	20	4923	CDCC310	DUCK5SC	16.09	1.98
0768	E	Conc Chnl 32'W 10'D 0:1 SS	200	4923	CDCC310	DUCK5SC	16.09	1.50
0772	E	Conc Chnl 30'W 6.5'D 0:1 SS	800	4831	CDCC285	DUCK5SC	14.88	2.00

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
DCWA		**DUCK CREEK WASH – continued**						
0785	E	2 Span Bridge 50'W 8'D @ Tomiyasu	60	4831	CDCC285	DUCK5SC	14.88	1.30
0786	E	Conc Chnl 50'W 7.0'D 0:1 SS	1150	4831	CDCC285	DUCK5SC	14.88	0.80
0814	E	Single Span Bridge 50'W 7.5'D @ Miravista	50	4831	CDCC285	DUCK5SC	14.88	1.30
0815	E	Conc Chnl 50'W 7.0'D 0:1 SS	480	4831	CDCC285	DUCK5SC	14.88	1.15
0824	E	Single Span Bridge 50'W 7.5'D @ La Casita	50	4831	CDCC285	DUCK5SC	14.88	1.30
0825	E	Conc Chnl 50'W 7.0'D 0:1 SS	780	4831	CDCC285	DUCK5SC	14.88	0.60
0840	E	2 Span Bridge 50'W 8.0'D	50	4831	CDCC285	DUCK5SC	14.88	1.20
0841	E	Conc Chnl 50'W 7.0'D 0:1 SS	230	4831	CDCC285	DUCK5SC	14.88	1.90
0845	E	3 Span Bridge 90'W 7'D @ UPRR	20	4831	CDCC285	DUCK5SC	14.88	1.50
0846	E	Natural Wash	130	4831	CDCC285	DUCK5SC	14.88	
0846	P1	Gabion Chnl 70'W 8'D 2:1 SS	130	4831	CDCC285	DUCK5SC	14.88	0.80
0847	E	4: 14.5' X 9.5' RCBC @ Warm Springs	100	4831	CDCC285	DUCK5SC	14.88	0.60
0848	E	Natural Wash	300	4831	CDCC285	DUCK5SC	14.88	
0848	P1	Gabion Chnl 60'W 9'D 2:1 SS	300	4831	CDCC285	DUCK5SC	14.88	0.70
0849	E	Dip Section @ Topaz	60	4831	CDCC285	DUCK5SC	14.88	
0849	P1	2 Span Bridge 100'W 7.5'D @ Topaz	60	4831	CDCC285	DUCK5SC	14.88	0.60
0850	P1	Gabion Chnl 65'W 8.5'D 2:1 SS	1320	4831	CDCC285	DUCK5SC	14.88	0.70
0883	E	4: 14' X 10' RCBC @ Eastern	100	4800	CDCC280	DUCK5SC	14.69	0.70
0884	E	Earth Chnl 65'W 5'D 3:1 SS	720	4800	CDCC280	DUCK5SC	14.69	0.68
0884	P1	Gabion Chnl 60'W 9'D 2:1 SS	720	4800	CDCC280	DUCK5SC	14.69	0.68
0898	E	Conc Chnl 100'W 10'D 0:1 SS	710	4467	CDCC280W	DUCK5SC	13.68	0.60
0912	E	Earth Chnl 55'W 5'D 4:1 SS	700	4467	CDCC280W	DUCK5SC	13.68	0.70
0912	P1	Gabion Chnl 60'W 8.5'D 2:1 SS	700	4467	CDCC280W	DUCK5SC	13.68	0.65
0925	P1	4: 14' X 7' RCBC @ Eldorado Lane	70	4467	CDCC280W	DUCK5SC	13.68	0.65
0926	E	Earth Chnl 45'W 5'D 4:1 SS	815	4467	CDCC280W	DUCK5SC	13.68	0.68
0926	P1	Gabion Chnl 60'W 8.5'D 2:1 SS	815	4467	CDCC280W	DUCK5SC	13.68	0.65
0941	P1	4: 14' X 8' RCBC @ Sur Este Ave	70	4445	CDCC270	DUCK5SC	13.57	0.60
0942	E	Earth Chnl 45'W 5'D 4:1 SS	300	4445	CDCC270	DUCK5SC	13.57	0.68
0942	P1	Conc Chnl 45'W 6.5'D 2:1 SS	300	4445	CDCC270	DUCK5SC	13.57	0.60
0948	E	7: 10' X 6' RCBC @ Spencer	80	4445	CDCC270	DUCK5SC	13.57	0.60
0949	E	Earth/Conc Chnl 70'W 6'D 2:1 SS	650	4445	CDCC270	DUCK5SC	13.57	0.68
0949	P1	Conc Chnl 70'W 5.5'D 2:1 SS with Concrete Bottom	650	4445	CDCC270	DUCK5SC	13.57	0.68
0965	E	6: 14' X 6' RCBC @ Robindale	80	4445	CDCC270	DUCK5SC	13.57	1.00
0966	E	Earth/Conc Chnl 70'W 6'D 2:1 SS	820	4445	CDCC270	DUCK5SC	13.57	0.53
0966	P1	Conc Chnl 70'W 5.5'D 2:1 SS with Concrete Bottom	820	4445	CDCC270	DUCK5SC	13.57	0.53
0979	E	Conc Chnl 70'W 6'D 2:1 SS	880	4445	CDCC270	DUCK5SC	13.57	1.00
0994	E	Single Span Bridge @ Beltway	170	4375	CDCC070S*	DUCK3SC	7.03	1.30
0997	E	Conc Chnl 70'W 6'D 2:1 SS	80	4375	CDCC070S*	DUCK3SC	7.03	1.00
0999	E	Conc Chnl 70'W 6'D 2:1 SS	140	4375	CDCC070S*	DUCK3SC	7.03	1.00
1003	E	Conc Chnl 70'W 6'D 2:1 SS	1140	4375	CDCC070S*	DUCK3SC	7.03	1.00
1021	E	3 Span Bridge 80'W 8'D @ Paradise/Maryland Pkwy	100	4375	CDCC070S	DUCK3SC	7.03	1.40
1023	E	Conc Chnl 70'W 6'D 2:1 SS	1130	4375	CDCC070S	DUCK3SC	7.03	1.10
1045	E	Conc Chnl 70'W 6'D 2:1 SS	30	4375	CDCC070S	DUCK3SC	7.03	1.10
1047	E	Single Span Bridge 45'W 10'D @ Windmill	120	4196	CBUB360	DUCK3SC	6.51	1.20
1049	E	Conc Chnl 12'W 15'D 1:1 SS	2150	2015	CBUB360S	DUCK3SC	3.07	1.50
1090	E	2 Span Bridge 80'W 25'D @ Pollock	80	2015	CBUB360S	DUCK3SC	3.07	2.10
1091	E	Conc Chnl 12'W 15'D 3:1 SS; 3.5' d/s	200	2015	CBUB360S	DUCK3SC	3.07	1.51
1102	E	Drop Structure		2015	CBUB360S	DUCK3SC	3.07	
1103	E	Conc Chnl 12'W 15'D 3:1 SS	200	2015	CBUB360S	DUCK3SC	3.07	1.51
1106	E	Drop Structure		2015	CBUB360S	DUCK3SC	3.07	
1107	E	Conc Chnl 12'W 15'D 3:1 SS	590	2015	CBUB360S	DUCK3SC	3.07	1.51
1121	E	Drop Structure		1833	CDCC050	DUCK3SC	2.74	
1122	E	Conc Chnl 20'W 20'D 3:1 SS	480	1833	CDCC050	DUCK3SC	2.74	0.50
1136	E	Conc Chnl 20'W 20'D 3:1 SS	2400	1833	CDCC050	DUCK3SC	2.74	1.51
1164	E	2 Span Bridge 100'W 9'D @ Pebble	100	1247	CDCC030	DUCK3SC	1.83	0.70
1165	E	Conc Chnl 30'W 8'D 2:1 SS	180	1247	CDCC030	DUCK3SC	1.83	1.51
1169	E	Conc Chnl 46'W 10'D 1.5:1 SS	2680	1247	CDCC030	DUCK3SC	1.83	0.90
1210	E	5: 15' X 8.5' RCBC @ Bermuda	100	725	CDCC02B	DUCK3SC	1.00	0.52
1212	E	Conc Chnl 80'W 8'D 0:1 SS	300	725	CDCC02B	DUCK3SC	1.00	0.86
1214	E	121,300 cfs PMF Spillway		121300	CDLDCDB	DUCK5SC	16.16	
1215	E	54" RCP Outlet	20	355	LDCDB	DUCK5SC	16.16	
1216	E	1,235 ac-ft Lower Duck Creek Detention Basin		5259	CDLDCDB	DUCK5SC	16.16	
1241	E	Natural Wash	540	4271	CDLD37B*	DUCK3SC	6.41	
1241	P2	2: 20' X 7' RCB	540	4271	CDLD37B*	DUCK3SC	6.41	1.94
MCE2		**MCCARRAN - EAST BRANCH 2**						
0000	E	48" RCP Outlet	3560	75	CDMCDB	DUCK3	1.78	0.70
0056	E	100-ac ft McCarran Detention Basin		1190	CDMC050	DUCK3	1.78	
PTAP		**PITTMAN ANTHEM PARKWAY**						
0000	P1	Conc Chnl 20'W 4.5'D 2:1 SS	100	1901	CPPE140	PIT3	2.18	5.00
0002	E	2: 8' X 8' RCBC @ St. Rose Pkwy	150	1901	CPPE140	PIT3	2.18	1.50
0005	E	Rip Rap Chnl 30'W 5'D 3:1 SS	525	1901	CPPE140	PIT3	2.18	1.30
0005	P1	Conc Chnl 20'W 5'D 2:1 SS	525	1901	CPPE140	PIT3	2.18	1.90
PTBL		**PITTMAN WASH - BELTWAY**						
0000	P1	Conc Chnl 50'W 6.5'D 2:1 SS	1000	5519	CPWA090	PIT3SC	7.93	0.70
0026	E	4: 12' X 8' RCBC @ I-215	360	5519	CPWA090	PIT3SC	7.93	1.00
0028	E	6: 12' X 8' and 1: 8' X 8' RCBC @ I-215	160	2224	CPWA085	PIT3SC	5.15	1.00
0034	E	Conc Chnl 12'W 6'D 2:1 SS	730	2224	CPWA085	PIT3SC	5.15	1.00
0053	E	12' X 6' RCB	860	2224	CPWA085	PIT3SC	5.15	1.70
0069	E	2: 13' X 6' RCB	1400	2224	CPWA085	PIT3SC	5.15	1.00
0095	P1	2: 13' X 6' RCB	590	1979	CPPE195	PIT3SC	5.39	1.00
0107	E	4: 72" RCP @ Silverado Ranch	600	1979	CPPE195	PIT3SC	5.39	2.00
0118	E	2: 11' X 6.2' Concrete Arch	1380	1979	CPPE195	PIT3SC	5.39	1.10
0144	E	Conc Chnl 25'W 6'D 0:1 SS	100	1979	CPPE195	PIT3SC	5.39	1.00
0146	E	2: 12' X 8' RCB	240	1768	NORTH	PIT3SC	5.15	1.00
0150	E	Conc Chnl 25'W 5.5'D 0:1 SS	40	1768	NORTH	PIT3SC	5.15	1.00
0151	E	2: 14' X 6' RCBC @ St. Rose Pkwy	40	1768	NORTH	PIT3SC	5.15	1.00
0157	E	Conc Chnl 25'W 5.5'D 0:1 SS	310	1768	NORTH	PIT3SC	5.15	1.00
PTBM		**PITTMAN WASH - BLACK MOUNTAIN**						
0000	E	2: 10' X 8' RCBC @ I-215	290	1589	CPRE060	PIT3	1.38	1.70
0005	E	Conc Chnl 20'W 4.5'D 2:1 SS	570	1589	CPRE060	PIT3	1.38	3.70
0018	E	2: 8' X 6' RCBC @ Las Palmas	50	1589	CPRE060	PIT3	1.38	3.70
0019	E	Conc. Chnl. 20'W 6'D 2:1 SS	1330	1589	CPRE060	PIT3	1.38	3.70
0044	E	2: 8' X 6' RCBC @ Paseo Verde	80	1166	CPRE050	PIT3	0.85	2.00
0045	P1	14' X 4' RCB	5700	1166	CPRE040	PIT3SC	0.85	4.00
PTDC		**PITTMAN WASH - DUCK CREEK**						
0027	E	Conc Chnl 60'W 7.9'D 0:1 SS	2000	6774	CPDC160	PIT5SC	23.80	0.85
0074	P0	Add 3: 10' X 8' RCBC @ I-515	160	6724	CPDC150	PIT5SC	23.54	0.80
0075	E	4: 10' X 8' RCBC @ I-515	160	6724	CPDC150	PIT5SC	23.54	0.80
0076	E	Conc Chnl 25'W 9'D 2:1 SS	960	6724	CPDC150	PIT5SC	23.54	1.20
0095	E	Single Span Bridge 75'W 8'D @ Stephanie	170	6299	CPDC120	PIT5SC	22.45	0.80
0096	E	Conc Chnl 30'W 8'D 2:1 SS	1150	6299	CPDC120	PIT5SC	22.45	0.80
0104	E	Conc Chnl 30'W 8'D 2:1 SS	520	5945	CPDC100	PIT5SC	19.63	0.80
0118	E	4 Span Bridge 60'W 8'D	70	5945	CPDC100	PIT5SC	19.63	1.30
0119	E	Conc. Chnl 30'W 8'D 2:1 SS	3430	5945	CPDC100	PIT5SC	19.63	0.80
0187	E	2 Span Bridge 42'W 8'D @ Sunset Road	100	5945	CPDC100	PIT5SC	19.63	1.40
0188	E	Conc Chnl 30'W 8'D 2:1 SS	2630	5777	CPDC030	PIT5SC	19.12	3.00
0237	E	2 Span Bridge 42'W 8'D @ Warm Springs	100	5777	CPDC030	PIT5SC	19.12	1.30

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
PTDW		**PITTMAN DESERT WILLOW**						
0000	E	Conc Chnl 29'W 5.5' D 2:1 SS	1550	1121	CPMR090	PIT3	2.19	2.20
0029	E	72" RCP	2140	568	DETB	PIT3	1.42	3.20
0069	E	78" RCP with 66" Orifice Plate Outlet	840	568	DETB	PIT3	1.42	1.40
0085	E	15 ac-ft Desert Willows Golf Course Detention Basin		1143	CPMR070	PIT3	1.42	
0088	E	Grass Chnl 100'W 5:1 SS	2090	1143	CPMR070	PIT3	1.42	2.20
PTEA		**PITTMAN WASH - EASTERN**						
0000	P2	Conc Chnl 24'W 8'D 0:1 SS	1000	3225	CPPE200	PIT3SC	6.71	1.60
0019	P2	2: 12' X 8' RCBC @ Serene	50	3225	CPPE200	PIT3SC	6.71	1.60
0020	P2	Conc Chnl 24'W 8'D 0:1 SS	2350	3225	CPPE200	PIT3SC	6.71	1.60
0054	P2	Conc Chnl 24'W 8'D 0:1 SS	1500	2284	CPPE205	PIT3SC	5.38	1.60
0090	E	3: 12' X 6' RCBC @ Eastern	200	2099	EAST	PIT3SC	5.15	1.70
0092	E	3: 10' X 6' RCB	820	2099	EAST	PIT3SC	5.15	2.40
0119	E	Conc Chnl 22'W 5'D 0:1 SS	200	2099	EAST	PIT3SC	5.15	2.00
0124	E	Splitter Structure		3892	CPPE155	PIT3SC	5.15	
0125	E	Conc Chnl 30'W 8'D 0:1 SS	740	3892	CPPE155	PIT3SC	5.15	1.20
0139	E	Earth Chnl 50'W 3:1 SS	800	3892	CPPE155	PIT3SC	5.15	1.20
0139	P3	Conc Chnl 30'W 8'D 0:1 SS	800	3892	CPPE155	PIT3SC	5.15	1.20
0145	E	3: 12' X 10' RCBC @ St. Rose Pkwy	80	2152	CPPE130	PIT3SC	2.97	0.90
0146	P3	Conc Chnl 20'W 6'D 2:1 SS	2100	2152	CPPE130	PIT3SC	2.97	1.00
PTFD		**PITTMAN FOOTHILLS DRIVE**						
0000	P1	Conc Chnl 15'W 4.5'D 2:1 SS	1330	1114	CPMR120	PIT3SC	1.32	3.00
0025	E	5: 12' X 4' RCBC @ Horizon Ridge Pkwy	70	1114	CPMR120	PIT3SC	1.32	10.00
0026	E	Conc Chnl 20'W 8'D 0:1 SS	1350	1114	CPMR120	PIT3SC	1.32	2.60
0050	E	20' X 10' RCAC @ Amador Ln	60	1114	CPMR120	PIT3SC	1.32	1.20
0051	E	Conc Chnl 13'W 6'D 1:1 SS	680	1114	CPMR120	PIT3SC	1.32	1.30
0063	E	16' X 6' RCAC @ Foothills Village Dr	550	1114	CPMR120	PIT3SC	1.32	2.60
0068	E	Natural Wash	2250	1114	CPMR120	PIT3SC	1.32	
0110	E	2: 14' X 10' RCBC @ MacDonald Ranch Dr	50	865	CPMR110	PIT3SC	1.00	3.10
0111	E	Natural Wash	2300	865	CPMR110	PIT3SC	1.00	
PTGB		**PITTMAN WASH - GIBSON**						
0058	P1	Conc Chnl 15'W 5.5'D 2:1 SS	1560	1532	CPBR080	PIT3SC	1.76	1.50
0087	P3	2: 10' X 6' RCB	660	1532	CPBR080	PIT3SC	1.76	0.50
0093	E	Earth/Conc Chnl 8'W 5'D 2:1 SS	550	1532	CPBR080	PIT3SC	1.76	1.50
0093	P1	Conc Chnl 30'W 5'D 0:1 SS	550	1532	CPBR080	PIT3SC	1.76	1.50
0133	E	3: 9' X 5' RCBC @ Cornucopia Ave	500	1532	CPBR080	PIT3SC	1.76	1.30
0134	E	Earth Chnl 15'W 6'D 2:1 SS	1270	1532	CPBR080	PIT3SC	1.76	0.80
0134	P1	Conc Chnl 13'W 6'D 2:1 SS	964	1532	CPBR080	PIT3SC	1.76	0.80
0156	E	2: 8' X 8' RCBC @ Sunset	280	1532	CPBR080	PIT3SC	1.76	1.10
0157	E	Earth Chnl 15'W 6'D 2:1 SS	820	1532	CPBR080	PIT3SC	1.76	0.80
0157	P1	2: 9' X 6' RCB	820	1532	CPBR080	PIT3SC	1.76	0.80
0165	E	2: 9' X 6' RCB	1270	1383	CPBR075	PIT3SC	1.60	1.30
0185	E	2: 9' X 6' RCB	330	879	CPBR055	PIT3SC	0.88	1.30
0208	E	2: 9' X 4' RCBC @ Warm Springs	110	879	CPBR055	PIT3SC	0.88	1.87
0210	E	Rip Rap Chnl 25'W 5'D 2:1 SS	1250	879	CPBR055	PIT3SC	0.88	1.60
0210	P2	2: 9' X 4' RCB	1250	879	CPBR055	PIT3SC	0.88	1.30
0235	E	2: 8' X 4' RCBC @ Kelso Dunes Ave	90	631	CPBR050	PIT3SC	0.65	1.50
0237	E	Conc Chnl 9'W 5'D 0:1 SS	550	631	CPBR050	PIT3SC	0.65	1.50
0247	E	2: 8' X 4' RCB	100	631	CPBR050	PIT3SC	0.65	1.50
0249	E	Conc Chnl 9'W 3.5'D 0:1 SS	700	631	CPBR050	PIT3SC	0.65	1.50
PTHR		**PITTMAN HORIZON RIDGE**						
0044	P1	Conc Chnl 15'W 5.5'D 2:1 SS	1250	1371	CPPD165	PIT3SC	1.25	1.20
0049	E	12' X 5' RCBC @ Lake Mead Dr	150	1345	CPPD160	PIT3SC	1.20	1.20
0067	E	8' X 5' RCB	1800	1345	CPPD160	PIT3SC	1.20	2.60
0104	P1	Conc Chnl 15'W 4.5'D 2:1 SS	1825	1345	CPPD160	PIT3SC	1.20	4.90
0139	E	36" RCP @ Horizon Ridge Pkwy	100	1065	CPPD135	PIT3SC	0.89	7.00
0139	P1	12' X 6' RCBC @ Horizon Ridge Pkwy	100	1065	CPPD135	PIT3SC	0.89	7.00
0140	P1	Conc Chnl 15'W 4'D 2:1 SS	3425	1065	CPPD135	PIT3SC	0.89	4.00
0203	P1	84" RCP Outlet	200	882	CPPD125	PIT3SC	0.72	4.00
0204	P1	882 cfs Spillway		882	CPPD125	PIT3SC	0.72	
0205	P1	2.5 ac-ft Pittman Horizon Ridge Debris Basin		882	CPPD125	PIT3SC	0.72	
PTLM		**PITTMAN LAKE MEAD**						
0000	E	12' X 6' RCBC @ I-215	350	888	CPMR200	PIT3	1.13	0.60
0010	E	Conc Chnl 18.5'W 5'D 0:1 SS	950	888	CPMR200	PIT3	1.13	1.00
0027	E	2: 12' X 5' RCBC @ Arroyo Grande	120	888	CPMR200	PIT3	1.13	1.00
0028	E	Conc Chnl 10'W 5'D 1.5:1 SS	1530	888	CPMR200	PIT3	1.13	1.00
0058	E	2: 12' X 5' RCBC @ Valle Verde	830	888	CPMR200	PIT3	1.13	1.00
0078	E	Conc Chnl 15'W 4.5'D 2:1 SS	6160	888	CPMR200	PIT3	1.13	1.00
PTMR		**PITTMAN MAC DONALD RANCH**						
0000	P1	Conc Chnl 30'W 6'D 2:1 SS	3180	4319	CPRE140	PIT4	11.82	2.20
0050	E	5: 12' X 6' RCBC @ I-215	480	4173	CPMR160	PIT4	11.52	0.60
0055	P1	Conc Chnl 25'W 6'D 2:1 SS	1250	3600	CPMR155	PIT4	10.40	2.00
0093	E	Earth Chnl	1500	3600	CPMR155	PIT4	10.40	2.00
0093	P1	Conc Chnl 25'W 6'D 2:1 SS	1500	3600	CPMR155	PIT4	10.40	2.00
0110	E	6: 11.5' X 5' RCBC @ Arroyo Grande	60	3297	CPMR164	PIT4	9.70	2.00
0111	E	Earth Chnl	730	3297	CPMR164	PIT4	9.70	2.00
0111	P1	Conc Chnl 25'W 6'D 2:1 SS	730	3297	CPMR164	PIT4	9.70	2.00
0132	P1	Conc Chnl 25'W 5.5'D 2:1 SS	3520	2776	CPMR165	PIT4	8.38	2.20
0188	E	24.5' X 8' RCAC @ Valle Verde	270	2749	CPMR130	PIT4	8.20	2.00
0190	E	Conc Chnl 31'W 6'D 2:1 SS	2080	2389	CPMR135	PIT3	5.66	1.00
0232	E	2: 20' X 8' RCAC @ High Mesa	70	2389	CPMR135	PIT3	5.66	0.50
0233	E	Grass Chnl 100'W 4'D 5:1 SS	3750	2389	CPMR135	PIT3	5.66	0.85
0320	E	4: 20' X 8.75' RCAC @ Horizon Ridge	190	2350	CPMR040	PIT3	5.31	1.90
0321	E	28' X 7.2' Concrete Arch	500	2350	CPMR040	PIT3	5.31	1.30
0331	P1	Conc Chnl 18'W 5.5'D 2:1 SS	2100	2350	CPMR040	PIT3	5.31	2.20
PTPE		**PITTMAN PECOS**						
0000	E	Grass Chnl 100'W 4'D 4:1 SS	2130	1547	CPWA210*	PIT3	1.81	2.00
0050	E	20' X 10' RCAC @ Wigwam	140	1547	CPWA210	PIT3	1.81	2.60
0051	E	Grass Chnl 50'W 4'D 4:1 SS	2350	1547	CPWA210	PIT3	1.81	2.00
0095	P0	Add 1: 10' X 4' RCBC @ Pebble	120	1547	CPWA210	PIT3	1.81	2.00
0096	E	6: 48" RCPC @ Pebble	120	1547	CPWA210	PIT3	1.81	2.00
0097	E	Rip Rap Chnl 38'W 6'D 2.5:1 SS	2200	1547	CPWA210	PIT3	1.81	2.60
0105	E	3: 10' X 7' RCBC @ I-215	230	1235	CPWA195	PIT3	1.25	2.50
0106	E	2: 6' X 6' RCBC @ I-215	180	580	CPWA190	PIT3	0.58	7.63
0107	P0	Conc Chnl 18'W 4'D 1.5:1 SS	1770	580	CPWA190	PIT3	0.58	0.70
0166	E	1: 10' X 6' RCBC @ Paseo Verde	330	580	CPWA190	PIT3	0.58	2.95
PTPW		**PITTMAN PECOS WEST**						
0000	P2	8' X 8' RCB	1650	1094	CPPE190	PIT3SC	1.33	1.20
0041	P2	Conc Chnl 24'W 4'D 2:1 SS	350	1094	CPPE190	PIT3SC	1.33	2.00
0060	E	2: 8' X 6' RCBC @ Ivanpah	50	1094	CPPE190	PIT3SC	1.33	2.00
0062	E	Conc Chnl 24'W 4.5'D 2:1 SS	900	1094	CPPE190	PIT3SC	1.33	0.70
0067	E	9' X 8' RCBC @ St. Rose Parkway	50	1094	CPPE190	PIT3SC	1.33	3.00
0068	E	Conc Chnl 40'W 4.5'D 2:1 SS	820	1094	CPPE190	PIT3SC	1.33	2.30
0082	E	2: 12' X 6' RCBC & 1: 10' X 6' RCBC @ Siena Heights	70	1094	CPPE190	PIT3SC	1.33	2.10
0083	E	Conc Chnl 40'W 4.5'D 2:1 SS	1270	1094	CPPE190	PIT3SC	1.33	2.30
0109	E	3: 12' X 6' RCBC & 1: 10' X 6' RCBC @ Coronado Ctr	50	698	CPPE180	PIT3SC	0.82	1.40

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
PTPW		**PITTMAN PECOS WEST – continued**						
0110	P1	Conc Chnl 15'W 4.5'D 2:1 SS	1500	698	CPPE180	PIT3SC	0.82	0.70
0136	E	4: 12' X 6' RCBC @ Horizon Ridge Pkwy	120	698	CPPE180	PIT3SC	0.82	2.00
0137	E	Conc Chnl 50'W 2:1 SS	3450	698	CPPE180	PIT3SC	0.82	2.00
PTRE		**PITTMAN RAILROAD EAST**						
0000	P1	60" RCP	2100	147	CPRE130	PIT5	15.79	0.50
0033	P2	57,800 cfs PMF Spillway		57800	CPRE130	PIT5	15.79	
0034	P2	54" RCP Outlet	150	147	PTRE0035	PIT5	15.79	
0035	P2	1,285 acre-ft Pittman Railroad East Detention Basin		5779	CPRE130	PIT5	15.79	
0037	E	Earth Chnl 50'W 10'D 2:1 SS	2100	3800	CPRE125	PIT3	3.97	0.07
0086	E	5: 10' X 8' RCBC @ Stephanie	110	3593	CPRE120	PIT3	3.60	0.07
0087	E	Earth Chnl 50'W 10'D 2:1 SS	1675	3593	CPRE120	PIT3	3.60	0.07
0098	E	Earth Chnl 25'W 10'D 2:1 SS	2475	1841	CPRE070	PIT3	1.64	0.10
0156	E	2: 10' X 8' RCBC @ Wigwam	190	1841	CPRE070	PIT3	1.64	0.10
0157	E	Earth Chnl 25'W 10'D 2:1 SS	1600	1841	CPRE070	PIT3	1.64	0.10
PTRW		**PITTMAN RAILROAD WEST**						
0000	E	Conc Chnl 10'W 5'D 2:1 SS	2950	702	CPWA280	PIT3	0.98	1.20
0053	E	14' X 5' RCBC @ Valle Verde	90	702	CPWA280	PIT3	0.98	0.60
0054	E	Conc Chnl 10'W 5.5'D 2:1 SS	3820	702	CPWA280	PIT3	0.98	0.90
0129	P0	Add 2: 6' X 4' RCBC @ Green Valley Pkwy	120	532	CPWA270	PIT3	0.73	0.38
0130	E	6' X 4' RCBC @ Green Valley Pkwy	120	532	CPWA270	PIT3	0.73	0.38
0131	E	Conc Chnl 10'W 5'D 2:1 SS	3850	532	CPWA270	PIT3	0.73	1.10
PTST		**PITTMAN STEPHANIE**						
0000	P1	Conc Chnl 34'W 5.5'D 2:1 SS	750	1955	CPRE110	PIT3	1.96	0.30
0016	E	16' X 6.5' RCAC	1660	1955	CPRE110	PIT3	1.96	3.60
0051	E	2: 12' X 6' RCBC @ Lake Mead	330	1955	CPRE110	PIT3	1.96	1.00
0052	P1	12' X 6.5' Concrete Arch	1380	1955	CPRE110	PIT3	1.96	3.00
0083	E	12' X 6.5' Concrete Arch	1280	1955	CPRE110	PIT3	1.96	3.40
0108	E	11' X 7' RCB	2480	1439	CPRE100	PIT3	1.43	3.70
0155	P1	11' X 5' RCB	830	1439	CPRE100	PIT3	1.43	3.60
0170	E	16' X 6' RCAC @ Quiet River	270	1439	CPRE100	PIT3	1.43	2.60
PTSW		**PITTMAN SANDWEDGE CHANNEL**						
0000	E	Conc Chnl 7'W 4.5'D 2:1 SS	1050	1438	CPWA250	PIT3	1.53	1.00
0019	E	3: 12' X 6' RCBC @ Windmill	120	1438	CPWA250	PIT3	1.53	1.20
0020	E	Natural Wash	3200	1438	CPWA250	PIT3	1.53	
0086	E	2: 66" RCP	690	611	CPWA235	PIT3	0.59	1.60
0092	E	Rip Rap Chnl 10'W 5'D 2:1 SS	330	611	CPWA235	PIT3	0.59	1.00
0097	E	2: 72" RCP @ Sandwedge	30	611	CPWA235	PIT3	0.59	3.00
0099	E	Rip Rap Chnl 32'W 5'D 2:1 SS	530	611	CPWA235	PIT3	0.59	3.10
0104	E	2: 72" RCP @ Bogey	50	611	CPWA235	PIT3	0.59	1.60
0105	E	Rip Rap Chnl 32'W 5'D 2:1 SS	1150	611	CPWA235	PIT3	0.59	3.10
0128	E	10' X 5' RCBC @ Bogey	90	611	CPWA235	PIT3	0.59	3.00
0129	E	Rip Rap Chnl 32'W 5'D 2:1 SS	530	340	PMR180	PIT3	0.32	3.10
PTVV		**PITTMAN VALLEY VERDE**						
0000	E	12' X 7' RCAC @ Horizon Ridge Pkwy	200	500	PMR090	PIT3	0.54	2.53
0004	E	Rip Rap Chnl 20'W 5'D 3:1 SS	140	500	PMR090	PIT3	0.54	0.50
0005	E	2: 60" RCP	840	500	PMR090	PIT3	0.54	3.60
PTVW		**PITTMAN WASH - VAN WAGENEN**						
0130	E	90" RCP	750	840	CPBR020	PIT3	0.71	1.07
0144	E	8' X 5' RCBC @ Commercial Way	70	840	CPBR020	PIT3	0.71	1.32
0145	E	84" RCP	620	553	CPBR010	PIT3	0.46	1.32
0157	E	90" RCP	300	553	CPBR010	PIT3	0.46	1.29
0163	E	72" RCP	2030	444	PTVW0165	PIT3SC	7.66	0.95
PTWA		**PITTMAN WASH**						
0000	E	Conc Chnl 30'W 7.5'D 2:1 SS	2850	5570	CPDC030	PIT5SC	19.12	3.00
0047	E	Single Span Bridge 70'W 12'D @ Santiago	80	5252	CPWA315	PIT5SC	18.00	0.50
0048	E	42" RCP Outlet	180	45	PTWA0050	PIT5SC	18.00	
0050	E	41 ac-ft Pittman Park Detention Basin		5252	CPWA315	PIT5SC	18.00	
0055	E	Conc Chnl 30'W 7.5'D 2:1 SS	920	6545	CPWA130*	PIT4SC	11.96	1.00
0077	E	Conc Chnl 30'W 8.5'D 2:1 SS	420	6545	CPWA130*	PIT4SC	11.96	2.10
0090	E	Single Span Bridge 60'W 12'D @ Arroyo Grande	80	6545	CPWA130*	PIT4SC	11.96	2.00
0091	E	Natural Wash	1740	6545	CPWA130*	PIT4SC	11.96	
0106	E	5 Span Bridge 181'W 31'D @ UPRR	110	6545	CPWA130*	PIT4SC	11.96	2.20
0107	E	Natural Wash	2400	6545	CPWA130*	PIT4SC	11.96	
0151	E	7: 10' X 8' RCBC @ Valley Verde	80	6545	CPWA130*	PIT4SC	11.96	1.70
0152	E	Natural Wash	4050	6545	CPWA130*	PIT4SC	11.96	1.00
0235	E	6: 10' X 8' RCBC @ Green Valley Prkwy	90	6545	CPWA130*	PIT4SC	11.96	1.10
0236	E	Gabion Chnl 60'W 10'D 3:1 SS	1800	6545	CPWA130*	PIT4SC	11.96	1.20
0275	E	Gabion Chnl 60'W 10'D 3:1 SS	3900	6545	CPWA130*	PIT4SC	11.96	1.20
0344	E	4 Span Bridge 120'W 10'D @ Pecos	100	6545	CPWA130	PIT4SC	11.96	1.00
0345	P1	Conc Chnl 30'W 8'D 2:1 SS	3750	6545	CPWA130	PIT4SC	11.96	1.11
0409	P0	Add 4: 10' X 5' RCBC @ Wigwam	80	6339	CPWA110	PIT4SC	11.17	1.00
0410	E	6: 10' X 5' RCBC @ Wigwam	80	6339	CPWA110	PIT4SC	11.17	1.00
0411	E	Earth Chnl 30'W 10'D 2:1 SS	2800	6339	CPWA110	PIT4SC	11.17	1.20
0411	P1	Conc Chnl 30'W 8'D 2:1 SS	2800	6339	CPWA110	PIT4SC	11.17	1.10
0476	E	6: 12' X 10' RCBC @ Pebble	120	6307	CPWA080	PIT4SC	10.93	1.20
0477	E	Earth Chnl 30'W 10'D 2:1 SS	170	6307	CPWA080	PIT4SC	10.93	1.20
0477	P1	Conc Chnl 30'W 8'D 2:1 SS	170	6307	CPWA080	PIT4SC	10.93	1.20
0485	E	Earth Chnl 30'W 10'D 2:1 SS	1150	1976	CPWA095	PIT3SC	2.85	0.80
0485	P1	Conc Chnl 15'W 6.5' D 2:1 SS	1150	1976	CPWA095	PIT3SC	2.85	0.80
0489	E	6: 12' X 8' & 1: 8' X 8' RCBC @ Eastern	160	1975	CPWA100	PIT3SC	2.80	1.20
0505	P1	Conc Chnl 12'W 6.5'D 2:1 SS	750	1975	CPWA100	PIT3SC	2.80	1.40
0540	E	Conc Chnl 15'W 5.5'D 2:1 SS	2250	1200	CPWA040	PIT3SC	1.35	0.50
0576	E	4: 13' X 8' RCBC @ I-215	700	1200	CPWA040	PIT3SC	1.35	1.00
0578	E	Conc Chnl 27.5'W 8.8'D 2:1 SS	1250	1200	CPWA040	PIT3SC	1.35	0.60
0615	E	3: 72" RCP	2000	1200	CPWA040	PIT3SC	1.35	0.50
0653	E	60" RCP	3770	1020	CPWA030	PIT3SC	1.05	0.80
0654	P0	Add Parallel 12' X 6' RCB	3770	1020	CPWA030	PIT3SC	1.05	0.80
0724	E	54" RCP	1330	81	PTWA0740	PIT3SC	5.76	0.30
0730	E	48" RCP	1100	81	PTWA0740	PIT3SC	5.76	0.30
0738	E	42" RCP Outlet	1500	81	PTWA0740	PIT3SC	5.76	0.30
0740	P0	Upgrade to 2,220 ac-ft Cactus Detention Basin		5151	CPCD150	PIT3SC	5.76	
0741	E	1,300 ac-ft Cactus Detention Basin		5151	CPCD150	PIT3SC	6.00	
PTWB		**PITTMAN WASH - WEST BELTWAY**						
0000	E	4: 10' X 6' RCBC @ I-215	800	729	CPWA070	PIT3SC	1.00	1.15
0016	E	Conc Chnl 20'W 6.5'D 2:1 SS	750	729	CPWA070	PIT3SC	1.00	2.30
WWDC		**WHITNEY WASH - DUCK CREEK**						
0000	E	Conc Chnl 15'W 6.5'D 2:1 SS	1400	1224	CPDC125	PIT3	2.59	0.80
0030	E	14' X 8.75' RCAC @ Whitney Ranch Rd	150	1224	CPDC125	PIT3	2.59	1.00
0033	E	Conc Chnl 15'W 6'D 2:1 SS	1000	1224	CPDC125	PIT3	2.59	0.60
0054	E	19' X 14' RCAC @ Galleria	70	1000	CPDC080	PIT3	2.33	0.90
0055	E	Conc Chnl 15'W 6.5'D 2:1 SS	750	1000	CPDC080	PIT3	2.33	0.80
0069	P1	Conc Chnl 15'W 5'D 2:1 SS	1470	1000	CPCD080	PIT3	2.33	0.60
0119	P0	Add 1: 14' X 4' RCB	890	1000	CPDC080	PIT3	2.33	0.60
0120	E	11' X 4' RCB	890	1000	CPDC080	PIT3	2.33	0.60
0149	P1	8,900 cfs PMF Spillway		8900	CPDC075	PIT3	1.26	
0150	P1	6' X 6' RCB Outlet	200	552	WWDC0151	PIT3	1.26	
0151	P1	35 ac-ft Whitney Wash Detention Basin		1077	CPDC075	PIT3	1.26	

*The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.

**As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.

REGIONAL FLOOD CONTROL DISTRICT

2002 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE FACILITY INVENTORY FIGURE F-21

LEGEND

Street Name Designator: AA BB (Parent Stream Name; Stream Name)	Existing Facility ..... E	Bottom Width ..... W	Cast in Place Concrete Pipe ..... CIPCP
ID / River Mile: 00 00 (Distance above confluence With parent stream; Miles in tenths)	Proposed or Modified Facility ..... P	Depth ..... D	Corrugated Metal Arch Pipe Culvert ..... CMAP
	Contingency Level	Side Slope, H:V ..... SS	Corrugated Metal Pipe Culvert ..... CMP
	Category B P0		High Density Polyethylene ..... HDPE
	Master Plan P1		Helical Elliptical Reinforced Concrete Pipe ..... HERCP
	Preliminary Design P2		Reinforced Concrete Arch Pipe ..... RCAC
	Design P3		

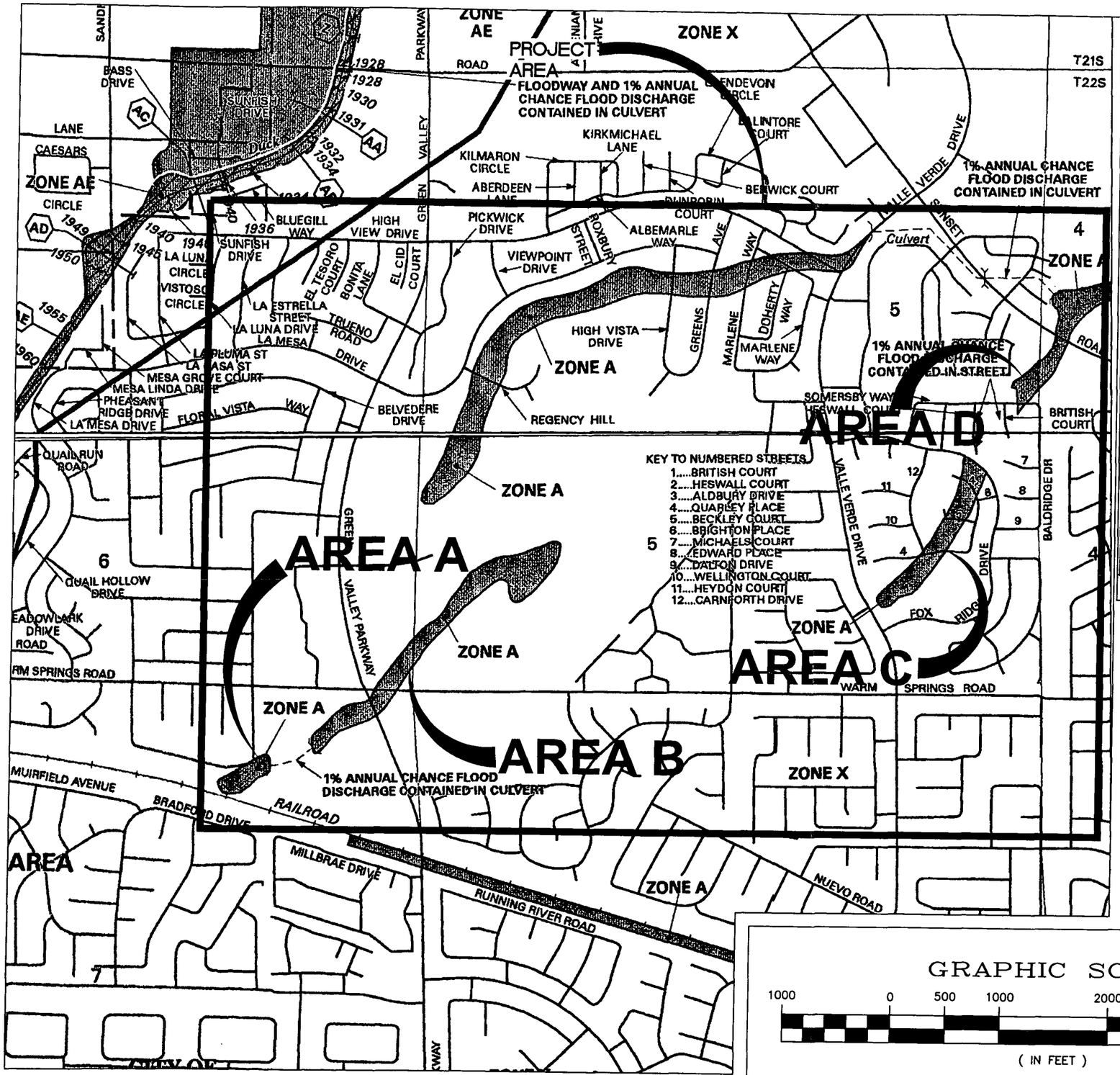
Construction Features

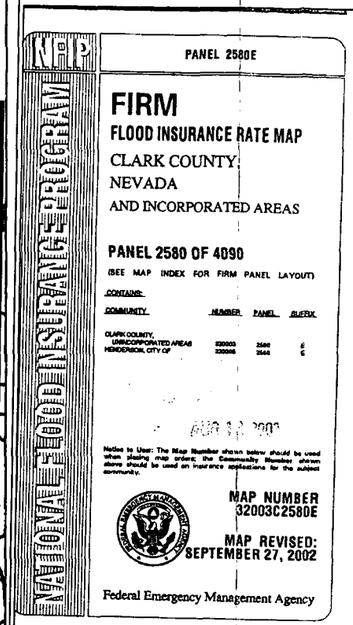
- Reinforced Concrete Box ..... RCB
- Reinforced Concrete Box Culvert ..... RCBC
- Reinforced Concrete Pipe ..... RCP
- Reinforced Concrete Pipe Culvert ..... RCPC
- Storm Sewer Pipe ..... SSP

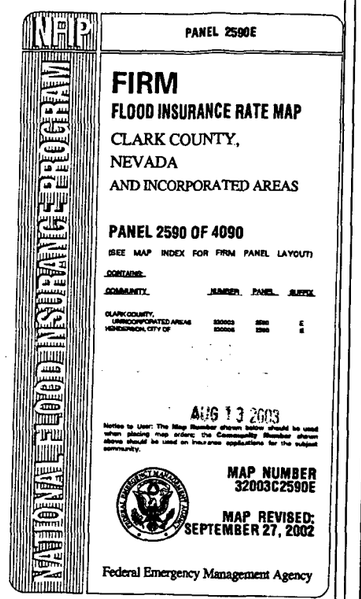
PBS&J

G.C. WALLACE, INC.

FIGURE 2A







GRAPHIC SCALE

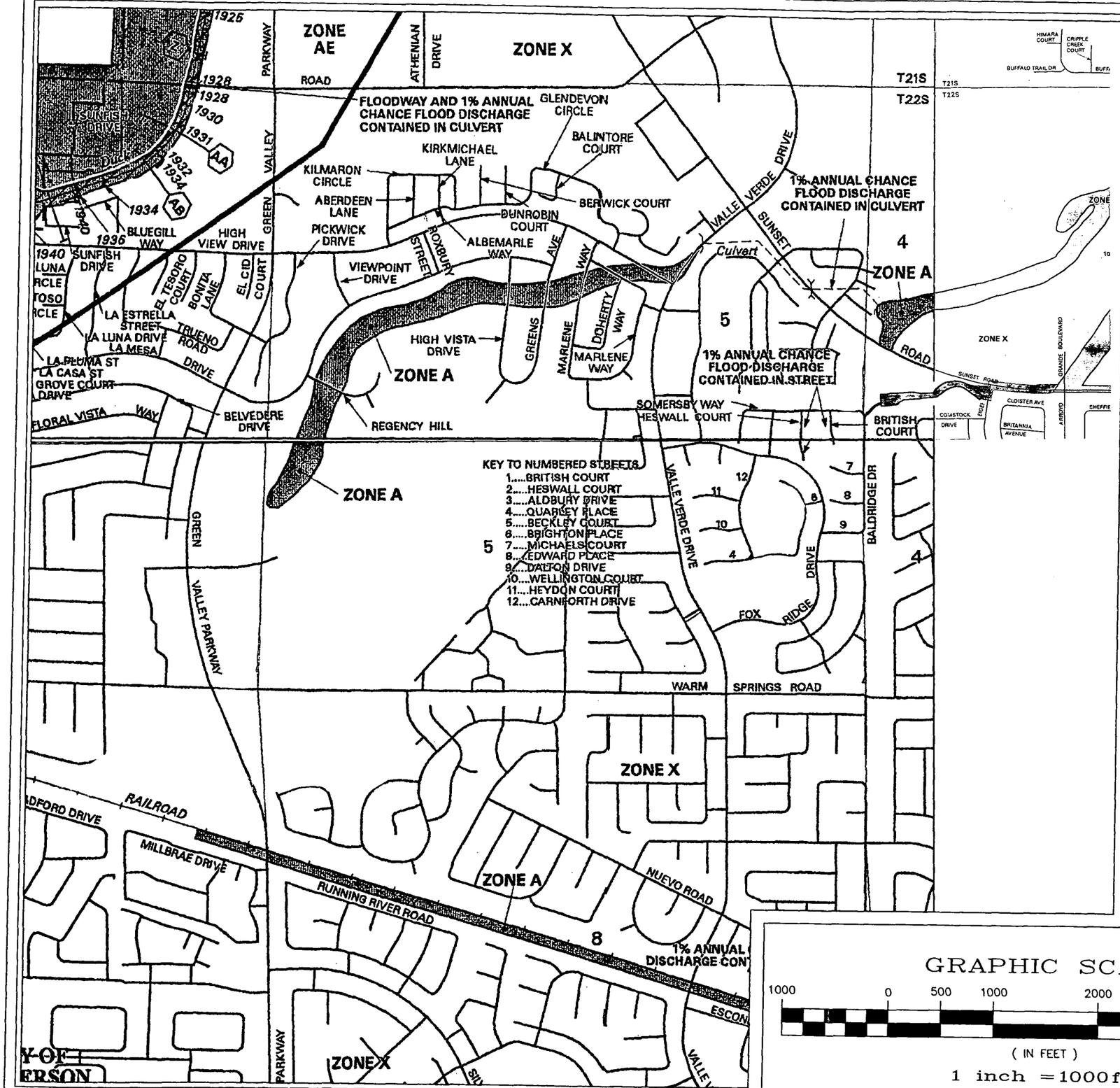
1000 0 500 1000 2000 4000

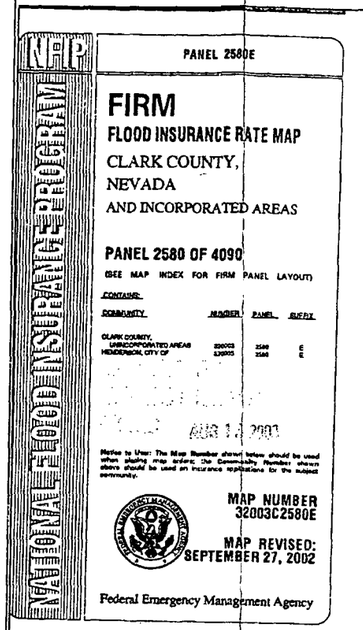
(IN FEET)

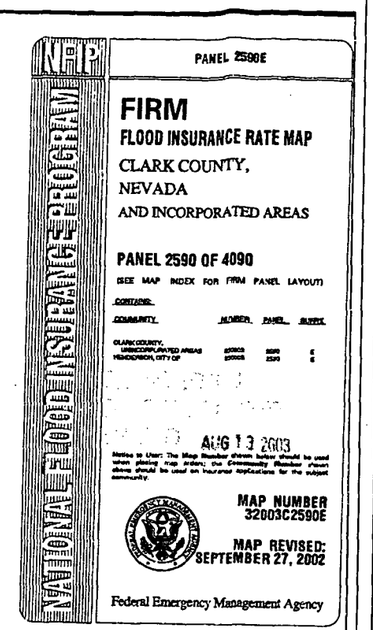
1 inch = 1000 ft.

FIGURE 3
FEMA FLOOD ZONE MAP

PBSJ
2270 Corporate Circle
Suite 1
Henderson, NV 89074
Phone: 702-263-7275
Fax: 702-263-7200
Engineering · Planning · Surveying · Construction Services







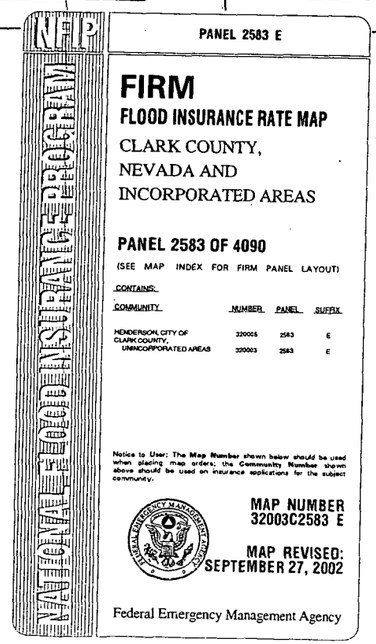


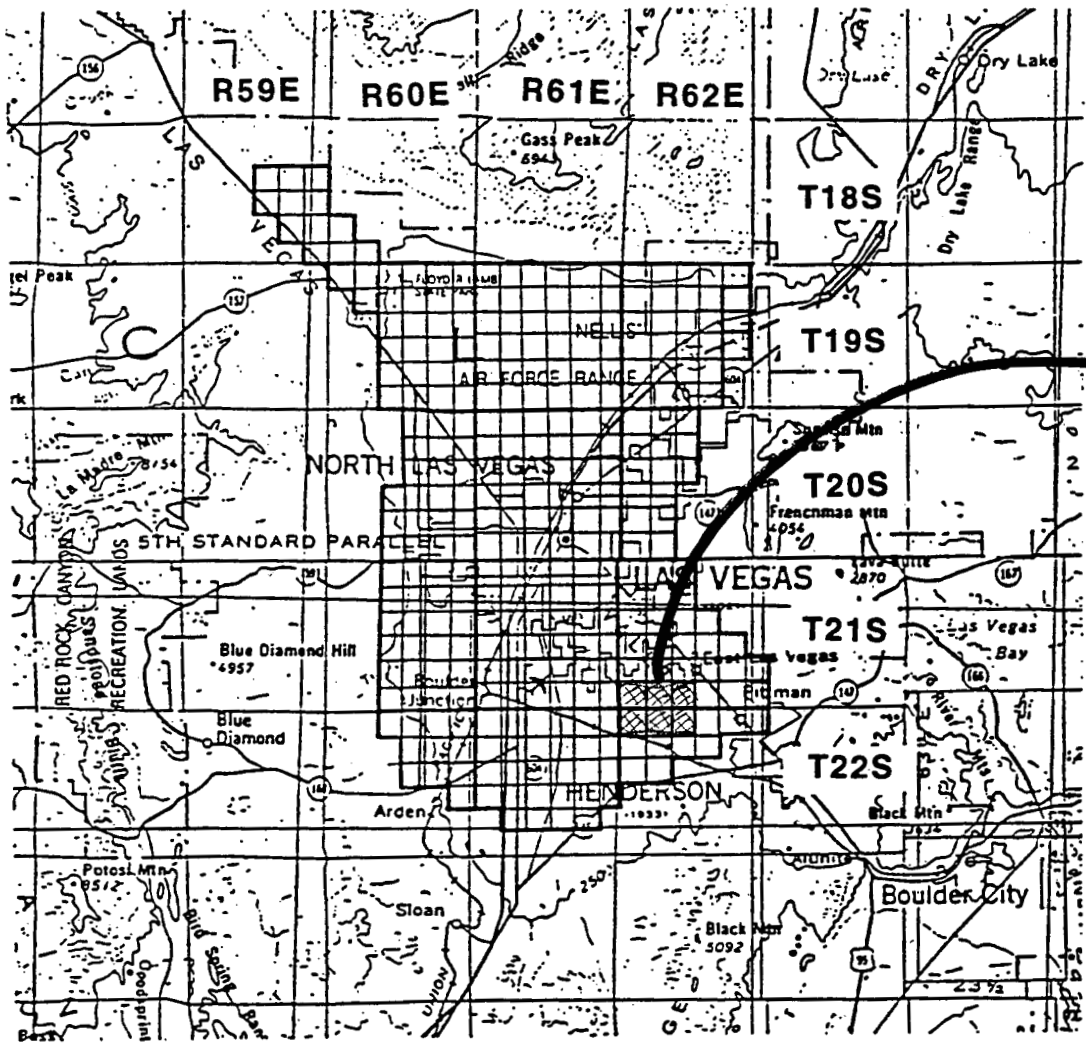
FIGURE 4
FEMA ANNOTATED FLOOD ZONE MAP

PBSJ
2270 Corporate Circle
Suite 1
Henderson, NV 89074
Phone: 702-263-7275
Fax: 702-263-7200
Engineering · Planning · Surveying · Construction Services

APPENDIX C
Hydrology

Hydrologic Parameters

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Notes:
1. Refer to Table 505 and Figure 516 Depth-Duration- Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

TIME	RECURRENCE INTERVAL 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5 min.	0.15	0.27	0.35	0.46	0.54	0.63
10 min.	0.25	0.44	0.57	0.74	0.89	1.02
15 min.	0.33	0.57	0.74	0.97	1.15	1.32
30 min.	0.44	0.78	1.01	1.31	1.55	1.79
1 hour	0.52	0.89	1.15	1.50	1.78	2.06
2 hour	0.59	1.01	1.30	1.70	2.01	2.30
3 hour	0.64	1.08	1.39	1.82	2.15	2.48
6 hour	0.72	1.22	1.58	2.05	2.41	2.77
24 hour (TR-55)	1.20	1.60	1.80	2.40	2.70	2.96

NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

Storm Time (In Minutes)	Percent of Total Storm Depth SDN3	SDN4	SDN5
0	0.0	0.0	0.0
5	2.0	2.0	2.0
10	5.7	5.8	5.9
15	7.0	7.5	8.0
20	8.7	9.9	11.0
25	10.8	12.6	14.4
30	12.4	13.7	15.0
35	13.0	14.5	16.0
40	13.0	14.9	16.8
45	13.0	15.1	17.1
50	13.0	15.5	18.0
55	13.0	15.6	18.2
60	13.0	15.9	18.7
65	13.3	16.2	19.0
70	14.0	16.9	19.7
75	14.2	17.2	20.2
80	14.8	17.9	21.0
85	15.8	18.9	22.0
90	17.2	20.1	23.0
95	18.1	21.1	24.1
100	19.0	22.0	25.0
105	19.7	22.8	25.9
110	19.9	23.2	26.5
115	20.0	24.0	28.0
120	20.1	24.6	29.0
125	20.4	25.2	30.0
130	21.4	26.0	30.5
135	22.9	26.9	30.9
140	24.1	27.6	31.0
145	24.9	28.3	31.7
150	25.1	28.6	32.1
155	25.6	29.2	32.7
160	27.0	30.2	33.3
165	27.8	31.2	34.6
170	28.1	32.1	36.1
175	28.3	33.2	38.1
180	29.5	35.2	40.8
185	32.2	37.6	43.0
190	35.2	41.5	47.7
195	40.9	46.2	51.4
200	49.9	53.0	56.1
205	59.0	61.0	63.0
210	71.0	71.0	71.0
215	74.4	73.2	72.0
220	78.1	75.6	73.1
225	81.2	78.2	75.2
230	81.9	79.9	77.9
235	83.5	81.3	79.0
240	85.1	82.3	79.5
245	85.6	83.0	80.4
250	86.0	83.5	81.0
255	86.8	84.4	82.0
260	87.6	85.1	82.6
265	88.8	86.4	84.0
270	91.0	88.5	85.9
275	92.6	90.8	88.9
280	93.7	92.4	91.0
285	95.0	94.4	93.8
290	97.0	96.8	96.6
295	97.6	97.3	97.0
300	98.2	97.8	97.4
305	98.5	98.2	97.9
310	98.7	98.4	98.1
315	98.9	98.6	98.3
320	99.0	98.8	98.5
325	99.3	99.1	98.9
330	99.3	99.2	99.0
335	99.4	99.3	99.2
340	99.5	99.4	99.3
345	99.8	99.7	99.6
350	99.8	99.8	99.7
355	99.9	99.9	99.9
360	100.0	100.0	100.0

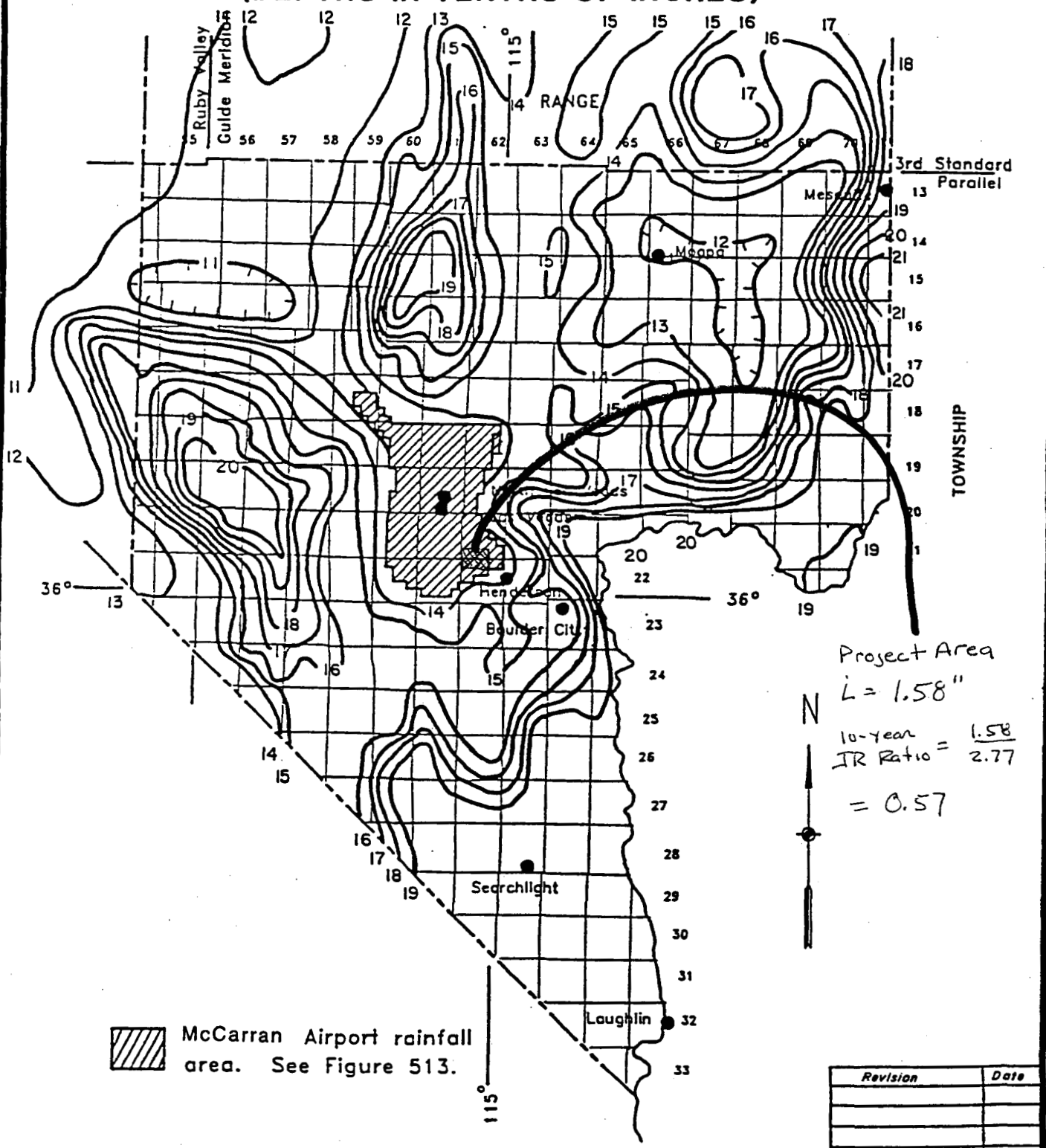
Notes:
1. For drainage areas less than 8 square miles in size, use SDN 3.
2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
4. A graphical representation of these values is presented on **Figure 515.**

Revision	Date

REFERENCE:

TABLE 503

RAINFALL DEPTH-DURATION-FREQUENCY
10-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



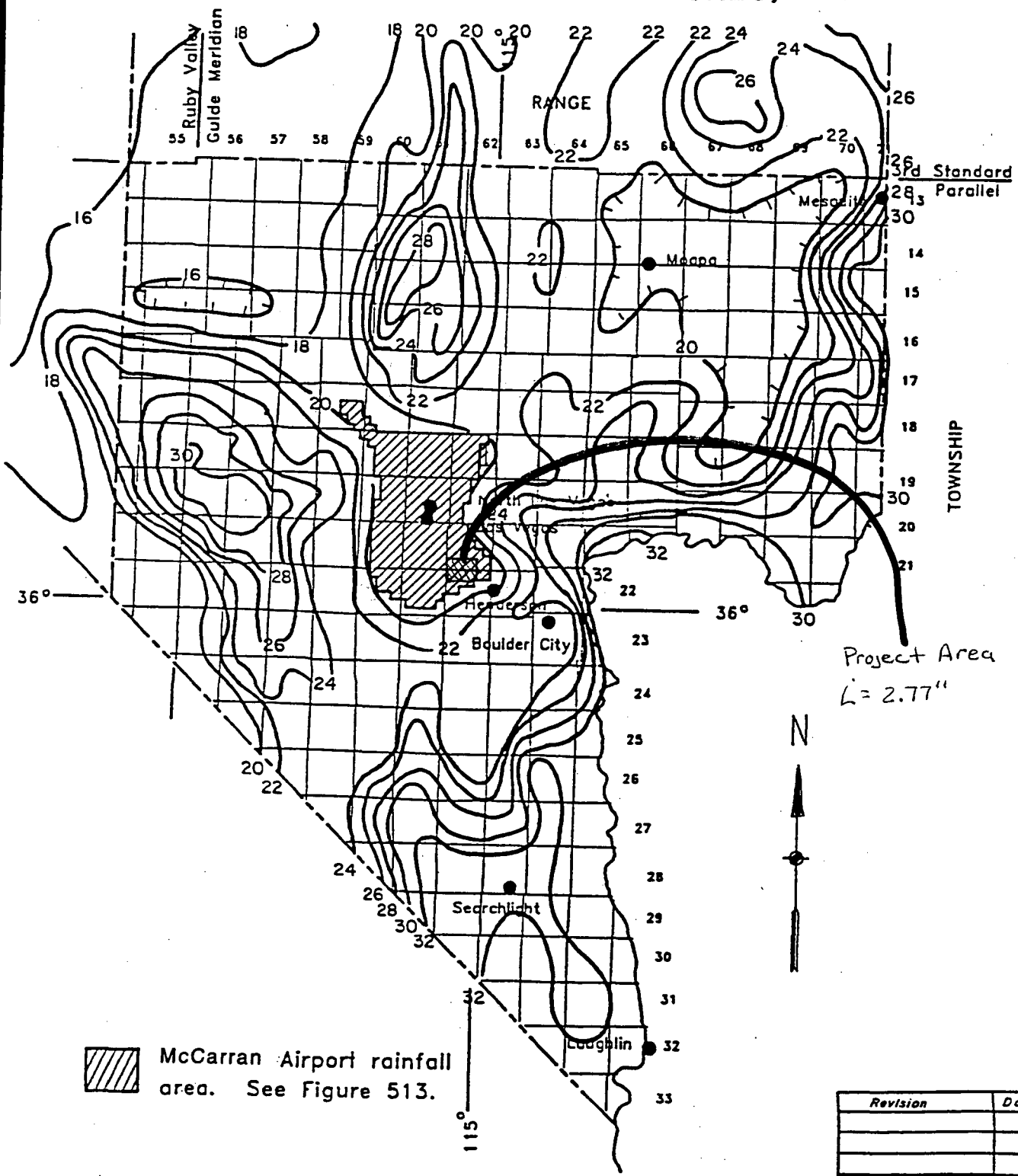
Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

RAINFALL DEPTH-DURATION-FREQUENCY
100-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



Revision	Date

WRC ENGINEERING	REFERENCE: NOAA ATLAS 2, VOLUME VII NEVADA, 1973	FIGURE 506

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]*Curve numbers for group A have been developed only for desert shrub.*

Revision	Date

WRC ENGINEERING

REFERENCE: SCS TR-55, USDA, June 1986.

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved: curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved: open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					

See Table 602A

Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

Average Lot Size or Usage[1]	Percent Impervious[2]	Curve Number for Hydrologic Soil Groups			
		A	B	C	D
Apartments/Condos	72	81	88	91	93
Townhouses/6,000 sq ft lots or less[3]	69	80	87	90	92
7,000 sq ft lots	63	76	84	89	91
8,000 sq ft lots	58	73	82	88	90
10,000 sq ft lots	38	61	75	83	87
14,000 sq ft lots	30	57	72	81	86
20,000 sq ft lots	25	54	70	80	85
40,000 sq ft lots	20	51	68	79	84
80,000 sq ft lots	12	46	65	77	82

1 Lot size should represent the size of the average lot and not the gross acreage divided by the number of lots.

2 Actual percent impervious value should be compared to selected land use type.

3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

Soil 302 50% D / 50% B

Revision	Date

REFERENCE:

TABLE 602A

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thickness	Depth	Hardness	Uncoated steel	Concrete
				Ft		In		In			
270---------- Land	B	Rare--------	---	3.5-6.0	Mar-Sep	>60	---	---	---	High------	High.
278---------- Land	D	Rare--------	---	1.5-3.0	Jan-Dec	>60	---	---	---	High------	High.
282---------- Land	C	Rare--------	---	3.0-3.5	Jan-Dec	>60	---	---	---	High------	High.
300, 301---------- Las Vegas	D	Rare--------	---	>6.0	---	>60	---	3-14	Thick	High------	High.
302*:											
Las Vegas--------	D	Rare--------	---	>6.0	---	>60	---	3-14	Thick	High------	High.
McCarran---------	B	Rare--------	---	>6.0	---	>60	---	---	---	High------	High.
Grapevine--------	B	Rare--------	---	>6.0	---	>60	---	---	---	High------	High.
305*:											
Las Vegas--------	D	Rare--------	---	>6.0	---	>60	---	3-14	Thick	High------	High.
Destazo----------	B	Rare--------	---	>6.0	---	>60	---	---	---	High------	High.
307*:											
Las Vegas--------	D	Rare--------	---	>6.0	---	>60	---	3-14	Thick	High------	High.
Skyhaven---------	C	Rare--------	---	>6.0	---	>60	---	24-40	Thick	High------	High.
325, 326---------- McCarran	B	Rare--------	---	>6.0	---	>60	---	---	---	High------	High.
341---------- Paradise	C	Rare--------	---	3.0-5.0	Dec-Mar	>60	---	---	---	High------	Low.
360*:											
Rock outcrop.											
St. Thomas-------	D	None--------	---	>6.0	---	4-20	Hard	---	---	High------	Low.
380---------- Skyhaven	C	Rare--------	---	>6.0	---	>60	---	24-40	Thick	High------	High.
390---------- Spring	C	Rare--------	---	>6.0	---	>60	---	---	---	High------	High.
400---------- Tencee	D	None--------	---	>6.0	---	>60	---	7-20	Thick	High------	Low.
415---------- Aztec	B	None--------	---	>6.0	---	>60	---	---	---	High------	High.
417*:											
Aztec----------	B	None--------	---	>6.0	---	>60	---	---	---	High------	High.
Rock outcrop.											
418*:											
Aztec----------	B	None--------	---	>6.0	---	>60	---	---	---	High------	High.
Nickel----------	B	None--------	---	>6.0	---	40-60	Hard	---	---	High------	Low.
Knob Hill--------	B	None--------	---	>6.0	---	>60	---	---	---	High------	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thickness	Depth	Hardness	Uncoated steel	Concrete
				Ft		In		In			
182*:											
Caliza	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Pittman	C	None	---	>6.0	---	>60	---	20-30	Thick	High	Low.
Arizo	A	Occasional	Mar-Sep	>6.0	---	>60	---	---	---	High	Low.
183--- Caliza	B	None	---	>6.0	---	>60	---	---	---	High	Low.
184--- Caliza	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
187--- Caliza	B	None	---	>6.0	---	>60	---	---	---	High	Low.
190--- Dalian	B	None	---	>6.0	---	>60	---	---	---	High	Low.
191--- Dalian	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
192*:											
Dalian	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
McCullough	B	Rare	---	>6.0	---	>60	---	---	---	High	Low.
200--- Glencarb	B	Rare	---	>6.0	---	>60	---	---	---	High	Moderate.
206--- Glencarb	C	Occasional	Jul-Sep	3.0-5.0	Jul-Jun	>60	---	---	---	High	High.
222--- Glencarb	C	Rare	---	3.0-5.0	Jul-Jun	>60	---	---	---	High	High.
236--- Glencarb	B	Rare	---	>6.0	---	>60	---	---	---	High	High.
237--- Glencarb	B	Rare	---	>6.0	---	>60	---	40-60	Thick	High	Low.
240--- Goodsprings	D	None	---	>6.0	---	>60	---	9-20	Thick	High	Low.
252, 255--- Grapevine	B	Rare	---	>6.0	---	>60	---	---	---	High	High.
260--- Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
262*:											
Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
Jean	A	Occasional	Jun-Sep	>6.0	---	>60	---	---	---	High	Low.
Goodsprings	D	Rare	---	>6.0	---	>60	---	9-20	Thick	High	Low.
263*:											
Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
Jean	A	Occasional	Jun-Sep	>6.0	---	>60	---	---	---	High	Low.
264--- Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare" and "occasional" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thickness	Depth	Hardness	Uncoated steel	Concrete
				Ft		In		In			
105*:											
McCullough	B	Rare	---	>6.0	---	>60	---	---	---	High	High.
Jean	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
Bluepoint	A	None	---	>6.0	---	>60	---	---	---	High	Low.
107---Arizo	A	Rare	---	>6.0	---	>60	---	---	---	High	Low.
112---Arizo	A	Occasional	Mar-Sep	>6.0	---	>60	---	---	---	High	Low.
113---Arizo	A	Rare	---	>6.0	---	>60	---	---	---	High	High.
117---Arizo	A	None	---	>6.0	---	>60	---	---	---	High	Low.
120---Bluepoint	A	Rare	---	4.0-6.0	Jun-Sep	>60	---	---	---	High	Moderate.
127, 128, 129---Bluepoint	A	None	---	>6.0	---	>60	---	---	---	High	Low.
130*:											
Bracken	B	None	---	>6.0	---	40-60	Soft	---	---	High	High.
Destazo	B	None	---	>6.0	---	>60	---	---	---	High	High.
132---Bracken	B	None	---	>6.0	---	40-60	Soft	---	---	High	High.
133*:											
Bracken	B	None	---	>6.0	---	40-60	Soft	---	---	High	High.
Rock outcrop.											
134---Bracken	B	None	---	>6.0	---	40-60	Soft	---	---	High	High.
140---Casaga	C	None	---	>6.0	---	>60	---	---	---	High	High.
150---Cave	D	None	---	>6.0	---	>60	---	4-20	Thick	High	Low.
151---Cave	D	None	---	>6.0	---	>60	---	10-20	Thick	High	Low.
152, 155---Cave	D	None	---	>6.0	---	>60	---	4-20	Thick	High	Low.
160---Destazo	B	None	---	>6.0	---	>60	---	---	---	High	High.
181*:											
Caliza	B	None	---	>6.0	---	>60	---	---	---	High	Low.
Pittman	C	None	---	>6.0	---	>60	---	20-30	Thick	High	Low.

See footnote at end of table.

flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used as habitat for desert wildlife and for recreation.

This unit is limited for roads because of the depth to an indurated hardpan and the dendritic pattern of straight-walled channels that are 5 to 20 feet deep. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation. Roads that cross the deep channels require bridging or deep cuts and fills and large culverts.

This map unit is in capability subclass VIIs, nonirrigated, and in horticultural group 6.

302—Las Vegas-McCarran-Grapevine complex, 0 to 4 percent slopes. This map unit is on basin floor remnants.

This unit is 40 percent Las Vegas gravelly fine sandy loam, 0 to 4 percent slopes; 25 percent McCarran fine sandy loam, 0 to 4 percent slopes, eroded; and 20 percent Grapevine very fine sandy loam, 0 to 4 percent slopes. The Las Vegas soil is on summits, the McCarran soil is on foot slopes, and the Grapevine soil is on shoulders of basin floor remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 5 percent areas of Badland; 5 percent Bluepoint soils on small sand sheets; and 5 percent Bracken soils on pediment remnants. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Las Vegas soil is shallow and well drained. It formed in alluvium derived from limestone and lacustrine sediment. Typically, the surface layer is very pale brown gravelly fine sandy loam about 1 inch thick. The upper 6 inches of the underlying material is very pale brown fine sandy loam, and the next 4 inches is very pale brown gravelly sandy clay loam. A white, indurated, lime-cemented hardpan is at a depth of about 11 inches. Depth to the hardpan ranges from 3 to 14 inches.

Permeability of the Las Vegas soil is moderately slow above the hardpan. Available water capacity is very low. Effective rooting depth is 3 to 14 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

The McCarran soil is very deep and well drained. It formed in alluvium derived from limestone, sandstone, and gypsiferous sediment. Typically, the surface layer is pink fine sandy loam about 5 inches thick. The underlying material is pink sandy loam and loam to a depth of 60 inches. Most of the subsurface layers are weakly cemented with lime and gypsum.

Permeability of the McCarran soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. This soil is slightly affected by salts to a depth of 5 inches, and it is moderately affected by salts below this depth.

The Grapevine soil is very deep and well drained. It formed in alluvium derived from various kinds of rock that have a high content of gypsiferous material. Typically, the surface layer is pink very fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is pink, stratified fine sandy loam to clay loam.

Permeability of the Grapevine soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. The soil is slightly affected by salts below a depth of 10 inches.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitations for construction of dwellings are the hazard of flooding on all soils and the depth to the hardpan in the Las Vegas soil. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Excavation for building sites is limited by the hardpan. Heavy equipment is needed for excavation. Gypsum in the McCarran and Grapevine soils can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion. Subsidence caused by the dissolution of gypsum in the McCarran soil can be prevented by using foundation drains, gutters, and downspouts that discharge directly into the sewer system.

The main limitations for septic tank absorption fields are depth to the hardpan in the Las Vegas soil and the restricted permeability of the McCarran soil. Excavation is limited by the hardpan. Special design of septic tank absorption fields is needed. Using long absorption lines and backfilling the trench with sandy material help to compensate for the restricted permeability.

The Las Vegas soil is limited for roads because of the depth to the hardpan. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation.

The main limitations for lawns and landscaping are depth to the hardpan in the Las Vegas soil and excess soluble salts in the McCarran soil. It is difficult to establish plants in areas where the pan is exposed. Mulching and fertilizing cut areas help to establish

minimize cuts. Heavy equipment is needed for excavation.

The main limitation for lawns and landscaping is the limited depth to the hardpan. It is difficult to establish plants in areas where the pan is exposed. Mulching and fertilizing cut areas help to establish plants. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

Intermittent streams form the drainageways in this unit. These drainageways are subject to rare or occasional periods of high-velocity flooding. Care should be exercised during urbanization to accommodate runoff from the drainageways. If drains become plugged during a major flood, accelerated erosion and damage to roads, buildings, and other structures can occur.

This map unit is in capability subclass VIIs, nonirrigated. It is in horticultural group 6.

252—Grapevine very fine sandy loam, 0 to 2 percent slopes. This very deep, well drained soil is on relict alluvial flats. It formed in alluvium derived from various kinds of rock.

Typically, about 10 percent of the surface is covered with a desert pavement of pebbles. The surface layer is pink very fine sandy loam about 1 inch thick. The upper 29 inches of the underlying material is pink and pinkish white fine sandy loam, the next 20 inches or more is pink very fine sandy loam, and the lower part to a depth of 54 inches is stratified, pink very fine sandy loam and reddish yellow fine sandy loam and has a few gypsum masses. The next layer to a depth of 69 inches or more is pink loam that has common gypsum masses. About 90 acres of this unit, 1 mile west of McCarran Airport, is strongly dissected and has a slope of 4 to 8 percent.

Included in this unit is about 5 percent Las Vegas soils on slightly higher relict alluvial flats.

Permeability of this Grapevine soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. The soil is slightly affected by salts below a depth of 5 inches.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Gypsum in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

Dikes and channels that have outlets for floodwater can be used to protect onsite sewage disposal systems from flooding. If the Grapevine soil is used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field.

Channeling and deposition can be minimized and maintenance costs reduced by protecting roads from flooding.

The main limitation for lawns and landscaping is the excess salts in the soil. Salts can be flushed out by using heavy periodic applications of water. Because of the content of gypsum and other salts in the soil, salt-tolerant plants should be selected. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

This map unit is in capability subclasses IIs, irrigated, and VIIc, nonirrigated. It is in horticultural group 2.

255—Grapevine loamy fine sand, 2 to 4 percent slopes. This very deep, well drained soil is on relict alluvial flats and basin floor remnants. It formed in alluvium derived from various kinds of rock.

Typically, about 50 percent of the surface is covered with a desert pavement of small pebbles and hardpan fragments. The surface layer is reddish yellow loamy fine sand about 10 inches thick. The underlying material to a depth of 60 inches or more is pink, stratified fine sandy loam to clay loam.

Included in this unit are about 5 percent Las Vegas soils on the slightly higher basin floor remnants and 5 percent McCarran soils on the relict alluvial flats. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Grapevine soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. The soil is slightly affected by salts below a depth of 10 inches.

This unit is used mainly for urban development. It is also used as habitat for desert wildlife and for recreation.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Gypsum in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

Dikes and channels that have outlets for floodwater can be used to protect onsite sewage disposal systems from flooding. If the Grapevine soil is used for septic tank absorption fields, the limitation of restricted

gravelly loamy fine sand, the next 17 inches is pink loamy fine sand, and the lower part to a depth of 60 inches or more is pink, stratified loamy sand to very fine sandy loam.

Included in this unit are about 5 percent Knob Hill soils and 5 percent Caliza soils on erosional fan remnants. Included areas make up about 10 percent of the total acreage.

Permeability of this Bluepoint soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Most areas of this unit are used as habitat for desert wildlife and for recreation. A few areas are used for urban development.

This Bluepoint soil is well suited to the construction of dwellings. Excavation for houses and access roads can expose material that is highly susceptible to soil blowing.

The main limitation for septic tank absorption fields is inadequate filtration of effluent. Because the substratum is highly permeable, special design may be needed to avoid polluting ground water and nearby water supplies.

Roads can easily be constructed and maintained on this unit. During prolonged dry periods, roads are difficult to maintain. Loose sand on the roads results in poor traction and increases the risk of soil blowing.

Removing the desert pavement is necessary for best results when landscaping, particularly in areas used for lawns. Because the soil is moderately droughty, applications of irrigation water should be light and frequent.

This map unit is in capability subclasses IIIs, irrigated, and VIIs, nonirrigated. It is in horticultural group 3.

129—Bluepoint loamy fine sand, 4 to 15 percent slopes. This very deep, somewhat excessively drained soil is on sand dunes on alluvial flats. It formed in eolian deposits derived dominantly from sandstone and quartzite. Areas are very irregular in shape and are 5 to 100 acres in size.

Typically, the surface layer is pink loamy fine sand 2 inches thick. The underlying material to a depth of 60 inches or more is pink fine sand.

Included in this unit are about 5 percent Land soils on recent alluvial flats and 5 percent Las Vegas soils and 5 percent McCarran soils on relict alluvial flats. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Bluepoint soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

Slope is a concern in designing and constructing dwellings on this unit. This unit is easily leveled if proper equipment is used. Excavation for houses and access roads can expose material that is highly susceptible to soil blowing.

The main limitation for septic tank absorption fields is inadequate filtration of effluent. Because the substratum is highly permeable, special design may be needed to avoid polluting ground water and nearby water supplies. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

Roads can easily be constructed and maintained on this unit if the proper equipment is used for leveling. During prolonged dry periods, roads are difficult to maintain. Loose sand on the roads results in poor traction and increases the risk of soil blowing.

Lawns and landscaping can be established and maintained through proper fertilizing, seeding, mulching, and shaping of the slopes. Because the soil is moderately droughty, applications of irrigation water should be light and frequent.

This map unit is in capability subclasses IVs, irrigated, and VIIs, nonirrigated. It is in horticultural group 3.

130—Bracken-Destazo complex, 2 to 15 percent slopes. This map unit is on dissected pediments.

This unit is 65 percent Bracken very cobbly fine sandy loam, 2 to 8 percent slopes, and 25 percent Destazo cobbly fine sandy loam, 8 to 15 percent slopes. The Bracken soil is on the summits of dissected pediments, and the Destazo soil is on the side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit is about 10 percent Las Vegas soils on summits of basin floor remnants. The percentage varies from one area to another.

The Bracken soil is deep and somewhat excessively drained. It formed in gypsiferous residuum derived dominantly from gypsiferous sedimentary rock that has a component of limestone. Typically, about 80 percent of the surface is covered with a desert pavement of cobbles and pebbles. The surface layer is pink very cobbly fine sandy loam about 1 inch thick. The upper 4 inches of the underlying material is pink gravelly sandy loam, the next 48 inches is pink gravelly sandy loam with 75 percent gypsum crystals, and the lower part to a depth of 60 inches or more is weakly consolidated, gypsiferous sediment. Depth to the gypsiferous sediment ranges from 40 to 60 inches or more.

Permeability of the Bracken soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is high if the surface is disturbed.

The Destazo soil is very deep and well drained. It formed in alluvium derived dominantly from limestone and dolomite. Typically, about 50 percent of the surface

is covered with a desert pavement of cobbles and pebbles. The surface layer is pink cobbly fine sandy loam about 10 inches thick. The upper 21 inches of the underlying material is light brown very gravelly sandy clay loam, and the lower part to a depth of 60 inches or more is pink gravelly sandy loam that contains some gypsum. The pebbles and cobbles in the soil are mostly indurated lime nodules.

Permeability of the Destazo soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

Slope is a concern in designing and constructing dwellings on the Destazo soil. Application of excess water may dissolve enough gypsum in the Bracken soil to cause soil subsidence. Because of the high content of gypsum, the soil can settle if the gypsum dissolves and leaches from the soil when it is irrigated. The risk of settlement can be reduced by avoiding excessive irrigation. Protection for buildings can be provided in some areas by placing perforated drain tile around the foundation and using sewers as outlets. Subsidence in urban areas caused by the dissolution of gypsum in the soil can be prevented by using gutters and downspouts that discharge directly into the sewer system. Gypsum in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

The main limitation for septic tank absorption fields on the Bracken soil is inadequate filtration of effluent. Because the substratum is highly permeable, special design may be needed to avoid polluting ground water and nearby water supplies. The main limitation for septic tank absorption fields on the Destazo soil is restricted permeability. The operation of septic tank absorption fields can be improved in some areas by placing the absorption lines below the less permeable subsoil.

Cutting and filling can be reduced by building roads in the less sloping areas of the unit. Runoff concentrated in drainage ditches can dissolve enough gypsum in the Bracken soil to cause soil subsidence.

The main limitation for lawns and landscaping is the large stones on the surface. The Bracken soil also has a very low available water capacity and a high content of gypsum. The desert pavement limits the use of most equipment. Removing the desert pavement is necessary for best results in landscaping. Frequent irrigation of lawns, gardens, and most other plantings is needed because of the very low available water capacity of the Bracken soil. Application of excess water can dissolve enough gypsum in the soil to cause soil subsidence. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

This map unit is in capability subclass VIIs, nonirrigated. The Bracken soil is in horticultural group 3, and the Destazo soil is in horticultural group 2.

132—Bracken very gravelly fine sandy loam, 2 to 8 percent slopes. This deep, somewhat excessively drained soil is on pediments and alluvial flats. It formed in gypsiferous alluvium derived from various kinds of rock high in gypsum.

Typically, about 90 percent of the surface is covered with a desert pavement of pebbles and cobbles. The surface layer is pink very gravelly fine sandy loam about 5 inches thick. The upper 12 inches of the underlying material is pink gravelly sandy loam, the next 32 inches is white gravelly sandy loam and gypsum crystals, and the lower part to a depth of about 60 inches or more is weakly consolidated, gypsiferous sediment. Depth to the gypsiferous sediment ranges from 40 to 60 inches or more.

Included in this unit are about 5 percent Grapevine soils and 5 percent McCarran soils on relict alluvial flats. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Bracken soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is high if the surface is disturbed.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

Because of the high content of gypsum, the soil can settle if the gypsum dissolves and leaches from the soil when it is irrigated. The risk of settlement can be reduced by avoiding excessive irrigation. Protection for buildings can be provided in some areas by placing perforated drain tile around the foundation and using sewers as outlets. Subsidence in urban areas caused by the dissolution of gypsum in the soil can be prevented by using gutters and downspouts that discharge directly into the sewer system. Gypsum in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

The main limitation for septic tank absorption fields is inadequate filtration of effluent. Because the substratum is highly permeable, special design may be needed to avoid polluting ground water and nearby water supplies.

Roads can easily be constructed and maintained on this unit. Concentrated runoff in drainage ditches can dissolve gypsum in the subsurface layers and cause subsidence.

The main limitation for lawns and landscaping is the very low available water capacity. Frequent irrigation of lawns, gardens, and most other plantings is needed.

GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)

1 inch =1000 ft.

FIGURE A-1: SOILS MAP

Soil Type Boundary

302 Hydrologic Soil Group

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE A-1

AREA A

HEC-1 Analysis & Figure A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

PBS&J, Inc. **DEVELOPMENT:** **AREA A**

Project No. : **511542.00**

File: STDRFRM4.XLS **CALCULATED BY :** **BKL** **DATE:** **October, 2003**

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc CHECK URBANIZED BASINS		FINAL Tc	Tlag	REMARKS
DESIG: (1)	CN	K (2)	AREA (acres) (3)	AREA (mi^2)	LENGTH (ft) (4)	SLOPE (%) (5)	Ti (min) (6)	LENGTH (ft) (7)	SLOPE (%) (8)	LAND COVER k	VELOCITY* (fps) (9)	Tt (min) (10)	Tc = Ti + Tt (min) (11)	TOTAL LENGTH (ft) (12)	Tc = (L/180)+10 (min) (13)	Tc = (min) (14)	Tlag= 0.6Tc/60 (hrs)	Q_{100}/Q_{10} (cfs)
EX1A	86.8	0.756	7.8	0.0122	120	1.0	6.8	1250	3.2	NA	4.45	4.7	11.5	1370	17.6	11.5	**0.115**	
EX2A	77.0	0.626	5.7	0.0089	50	1.0	6.0	1300	2.6	NA	2.42	9.0	15.0	1350	17.5	15.0	**0.150**	

Tc = Ti + Tt Ti = 1.8 (1.1 - K) L^1/2 / S^1/3

Tlag = 0.6Tc K = 0.0132 (CN) - 0.39

*** The velocity in column 9 is based on approximate channel properties.**

REFERENCE :

STANDARD FORM 4

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   03NOV03  TIME  09:51:27  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X        XX
X     X  X        X              X X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
            1           ID  ************************************
            2           ID      File: AREAA.DAT                *
            3           ID      OCTOBER 2003                   *
            4           ID                                     *
            5           ID      UPRR FIS                       *
            6           ID      EXISTING DRAINAGE CONDITIONS   *
            7           ID                                     *
            8           ID  ************************************
            9           ID
                        *DIAGRAM
 *** FREE ***
           10           IT       3       0       0     300
           11           IO       5       0       0
           12           IN       5       0       0
           13           JR    PREC    0.57    1.00
                        *
           14           KK    EX1A
           15           KM   EXISTING RESIDENTIAL BASIN
           16           BA  0.0122
           17           PB    2.77
           18           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           19           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           20           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           21           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           22           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           23           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           24           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           25           PC    .998    .999   1.00
           26           LS       0   86.8
           27           UD   0.115
                        *
           28           KK    EX2A
           29           KM   EXISTING UNDEVELOPED BASIN
           30           BA  0.0089
           31           LS       0      77
           32           UD   0.150
                        *
           33           KK      C1
           34           KM   COMBINE EX1 AND EX2
           35           HC       2
                        *
           36           ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    14        EX1A
                .
                .
    28          .        EX2A
                .          .
                .          .
    33          C1.........
```

```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN  1998                 *
 *          VERSION 4.1                  *
 *                                       *
 *  RUN DATE   03NOV03  TIME  09:51:27   *
 *                                       *
 *****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*          (916) 756-1104           *
*                                   *
*************************************
```

```
                        ************************************
                            File: AREAA.DAT                *
                            OCTOBER 2003                   *
                                                           *
                            UPRR FIS                       *
                            EXISTING DRAINAGE CONDITIONS   *
                                                           *
                        ************************************

   11 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                        NMIN           3  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME         0000  STARTING TIME
                          NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1    0  ENDING DATE
                      NDTIME         1457  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL      .05 HOURS
                         TOTAL TIME BASE   14.95 HOURS

           ENGLISH UNITS
                DRAINAGE AREA          SQUARE MILES
                PRECIPITATION DEPTH    INCHES
                LENGTH, ELEVATION      FEET
                FLOW                   CUBIC FEET PER SECOND
                STORAGE VOLUME         ACRE-FEET
                SURFACE AREA           ACRES
                TEMPERATURE            DEGREES FAHRENHEIT

      JP          MULTI-PLAN OPTION
                        NPLAN          1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                       .57      1.00
1

               PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                                TIME TO PEAK IN HOURS


                                                                    RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN                    RATIO 1  RATIO 2
                                                                 .57     1.00

 HYDROGRAPH AT
+                   EX1A       .01     1   FLOW                  7.      18.
                                           TIME                3.55     3.55

 HYDROGRAPH AT
+                   EX2A       .01     1   FLOW                  2.       7.
                                           TIME                3.60     3.60

  2 COMBINED AT
+                    C1        .02     1   FLOW                  8.      25.
                                           TIME                3.55     3.55


 *** NORMAL END OF HEC-1 ***
```

VELOCITY ESTIMATE EX1A
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX1A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	3.2000	%
Discharge	18.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.36	ft
Elevation Range	0.00 to 1.00	
Flow Area	4.0	ft²
Wetted Perimeter	30.72	ft
Top Width	30.25	ft
Actual Depth	0.36	ft
Critical Elevation	0.46	ft
Critical Slope	0.6371	%
Velocity	4.45	ft/s
Velocity Head	0.31	ft
Specific Energy	0.67	ft
Froude Number	2.14	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00

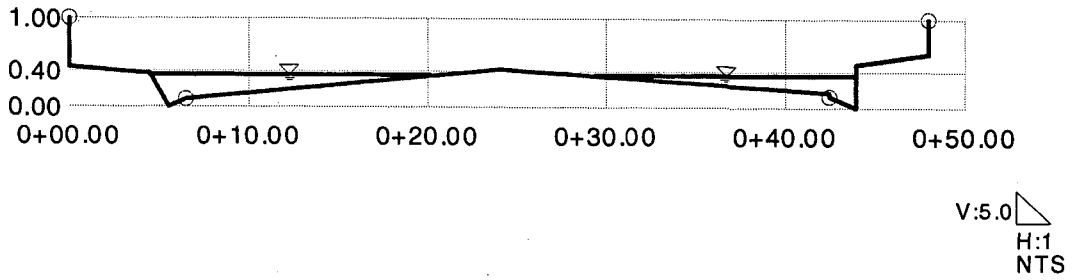
VELOCITY ESTIMATE EX1A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50
0+48.00	0.60
0+48.00	1.00

VELOCITY ESTIMATE EX1A
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX1A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.015	
Slope	3.2000	%
Water Surface Elevation	0.36	ft
Elevation Range	0.00 to 1.00	
Discharge	18.00	cfs



VELOCITY ESTIMATE EX2A
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX2A
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

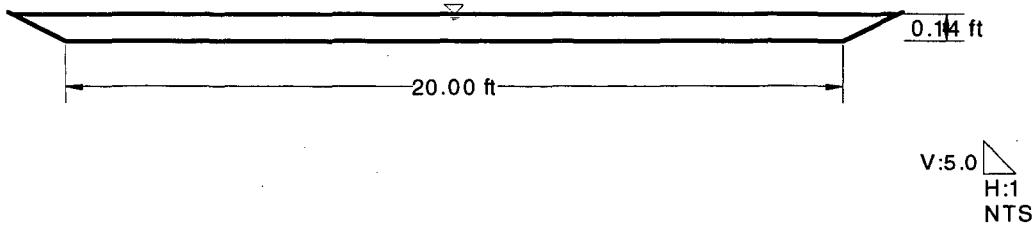
Input Data		
Mannings Coefficient	0.025	
Slope	2.6000	%
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	7.00	cfs

Results		
Depth	0.14	ft
Flow Area	2.9	ft²
Wetted Perimeter	22.72	ft
Top Width	22.71	ft
Critical Depth	0.15	ft
Critical Slope	1.7469	%
Velocity	2.42	ft/s
Velocity Head	0.09	ft
Specific Energy	0.23	ft
Froude Number	1.20	
Flow Type	Supercritical	

VELOCITY ESTIMATE EX2A
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX2A
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.025	
Slope	2.6000	%
Depth	0.14	ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	7.00	cfs



GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)

1 inch = 400 ft.

FIGURE A: AREA A DRAINAGE MAP

Floodzone

Basin Flow Summary
EXISTING CONDITION

BASIN / COMB PT ID	BASIN AREA (acres)	Q_{10} (cfs)	Q_{100} (cfs)	VELOCITY (fps)
EX1A	7.8	7	18	4.45
EX2A	5.7	2	7	2.42
C1	NA	8	25	NA

LEGEND

EX1	Basin Name
———	Basin Boundary
→	Flow Arrow
—(A)	Cross-Section
● C1	Combination Point

N

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE A

AREA B

HEC-1 Analysis & Figure B

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

PBS&J, Inc. **DEVELOPMENT:** **AREA B**

Project No. : **511542.00**

File: STDRFRM4.XLS **CALCULATED BY :** **BKL** **DATE:** **OCTOBER, 2003**

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc CHECK URBANIZED BASINS		FINAL Tc	Tlag	REMARKS
DESIG: (1)	CN	K (2)	AREA (acres) (3)	AREA (mi^2)	LENGTH (ft) (4)	SLOPE (%) (5)	Ti (min) (6)	LENGTH (ft) (7)	SLOPE (%) (8)	LAND COVER k	VELOCITY* (fps) (9)	Tt (min) (10)	Tc = Ti + Tt (min) (11)	TOTAL LENGTH (ft) (12)	Tc = (L/180)+10 (min) (13)	Tc = (min) (14)	Tlag= 0.6Tc/60 (hrs)	Q_{100}/Q_{10} (cfs)
EX1B	89	0.785	54.8	0.0856	200	1.0	8.0	4800	1.50	NA	5.9	13.5	21.5	5000	37.8	21.5	**0.215**	
EX2B	87	0.758	9.3	0.0145	100	1.0	6.1	700	1.10	NA	3.6	3.3	9.4	800	14.4	9.4	**0.094**	
EX3B	88	0.772	2.3	0.0036	100	1.0	5.9	350	1.20	NA	2.3	2.5	8.5	450	12.5	8.5	**0.085**	
EX4B	92	0.824	11.4	0.0178	200	1.5	6.1	800	1.50	NA	4.5	3.0	9.1	1000	15.6	9.1	**0.091**	
EX5B	92	0.824	4.7	0.0073	100	1.0	5.0	600	1.50	NA	3.3	3.1	8.0	700	13.9	8.0	**0.080**	
EX6B	98	0.904	3.5	0.0055	50	2.0	2.0	1600	1.00	NA	2.5	10.6	12.6	1650	19.2	12.6	**0.126**	
EX7B	89	0.785	19.3	0.0302	250	1.1	8.7	800	1.37	NA	5.0	2.7	11.4	1050	15.8	11.4	**0.114**	
EX8B	78	0.640	17.7	0.0277	350	1.5	13.5	1300	2.00	NA	3.4	6.4	20.0	1650	19.2	19.2	**0.192**	

Tc = Ti + Tt Ti = 1.8 (1.1 - K) L^1/2 / S^1/3

Tlag = 0.6Tc K = 0.0132 (CN) - 0.39

*** The velocity in column 9 is based on approximate channel properties.**

REFERENCE :

STANDARD FORM 4

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   18NOV03  TIME  11:26:33   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
X    X  XXXXXXX   XXXXX          X
X    X  X        X     X        XX
X    X  X        X              X
XXXXXXX  XXXX    X        XXXXX  X
X    X  X        X              X
X    X  X        X     X        X
X    X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

            1       ID  ***********************************
            2       ID      File: AREAB.DAT                *
            3       ID      OCTOBER 2003                   *
            4       ID                                     *
            5       ID      UPRR FIS                       *
            6       ID      EXISTING DRAINAGE CONDITIONS   *
            7       ID                                     *
            8       ID  ***********************************
            9       ID
                    *DIAGRAM
*** FREE ***
           10       IT       3       0       0     300
           11       IO       5       0       0
           12       IN       5       0       0
           13       JR    PREC    0.57    1.00
                    *
           14       KK    EX1B
           15       KM   EXISTING RESIDENTIAL BASIN
           16       BA  0.0856
           17       PB    2.77
           18       PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           19       PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           20       PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           21       PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           22       PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           23       PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           24       PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           25       PC    .998    .999   1.00
           26       LS       0      89
           27       UD   0.215
                    *
           28       KK    EX2B
           29       KM   EXISTING APARTMENT BASIN
           30       BA  0.0145
           31       LS       0      87
           32       UD   0.094
                    *
           33       KK    EX3B
           34       KM   EXISTING APARTMENT BASIN
           35       BA  0.0036
           36       LS       0      88
           37       UD   0.085
                    *
           38       KK    EX4B
           39       KM   EXISTING COMMERCIAL BASIN
           40       BA  0.0178
           41       LS       0      92
           42       UD   0.091
                    *
```

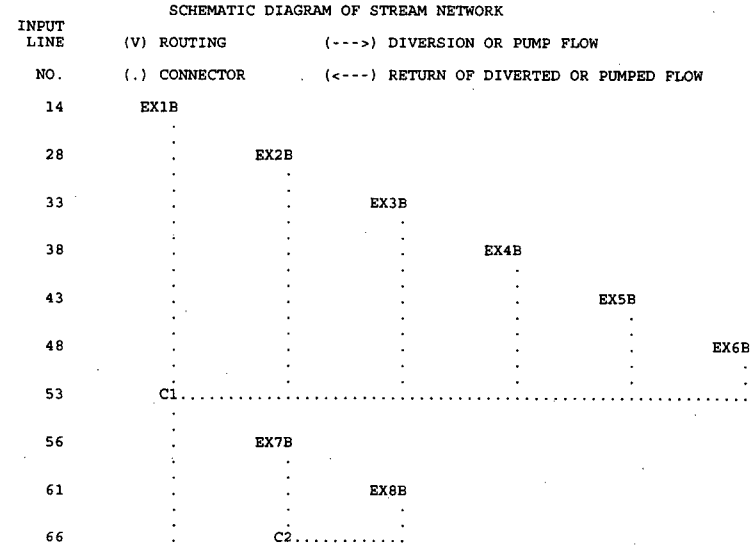
1 HEC-1 INPUT PAGE 2

```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

           43       KK    EX5B
           44       KM   EXISTING COMMERCIAL BASIN
```

```
45          BA  0.0073
46          LS       0      92
47          UD   0.080
            *

48          KK    EX6B
49          KM   EXISTING GVP BASIN
50          BA  0.0055
51          LS       0      98
52          UD   0.126
            *

53          KK      C1
54          KM   COMBINE EX1B, EX2B, EX3B, EX4B, EX5B, AND EX6B
55          HC       6
            *

56          KK    EX7B
57          KM   EXISTING APARTMENT BASIN
58          BA  0.0302
59          LS       0      89
60          UD   0.114
            *

61          KK    EX8B
62          KM   EXISTING GOLF COURSE BASIN
63          BA  0.0277
64          LS       0      78
65          UD   0.192
            *

66          KK      C2
67          KM   COMBINE EX7B AND EX8B
68          HC       2
            *
69          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*          VERSION 4.1                  *
*                                       *
*  RUN DATE   18NOV03  TIME  11:26:33   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
*************************************
   File: AREAB.DAT                 *
   OCTOBER 2003                    *
                                   *
   UPRR FIS                        *
   EXISTING DRAINAGE CONDITIONS    *
                                   *
*************************************
```

```
  11 IO          OUTPUT CONTROL VARIABLES
```

	IPRNT	5	PRINT CONTROL
	IPLOT	0	PLOT CONTROL
	QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

	NMIN	3	MINUTES IN COMPUTATION INTERVAL
	IDATE	1 0	STARTING DATE
	ITIME	0000	STARTING TIME
	NQ	300	NUMBER OF HYDROGRAPH ORDINATES
	NDDATE	1 0	ENDING DATE
	NDTIME	1457	ENDING TIME
	ICENT	19	CENTURY MARK

COMPUTATION INTERVAL .05 HOURS
TOTAL TIME BASE 14.95 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	EX1B	.09	1	FLOW	46.	108.
				TIME	3.65	3.65
HYDROGRAPH AT						
+	EX2B	.01	1	FLOW	9.	22.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX3B	.00	1	FLOW	2.	6.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX4B	.02	1	FLOW	15.	32.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX5B	.01	1	FLOW	6.	13.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	EX6B	.01	1	FLOW	6.	11.
				TIME	3.55	3.55
6 COMBINED AT						
+	C1	.13	1	FLOW	78.	180.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX7B	.03	1	FLOW	20.	48.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX8B	.03	1	FLOW	6.	22.
				TIME	3.65	3.65
2 COMBINED AT						
+	C2	.06	1	FLOW	24.	67.
				TIME	3.55	3.55

*** NORMAL END OF HEC-1 ***

VELOCITY ESTIMATE EX1B
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX1B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	1.5000 %
Discharge	108.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.94	ft
Elevation Range	0.00 to 2.00	
Flow Area	18.3	ft²
Wetted Perimeter	46.37	ft
Top Width	45.47	ft
Actual Depth	0.94	ft
Critical Elevation	1.10	ft
Critical Slope	0.5081	%
Velocity	5.92	ft/s
Velocity Head	0.54	ft
Specific Energy	1.48	ft
Froude Number	1.65	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+50.00	0.017

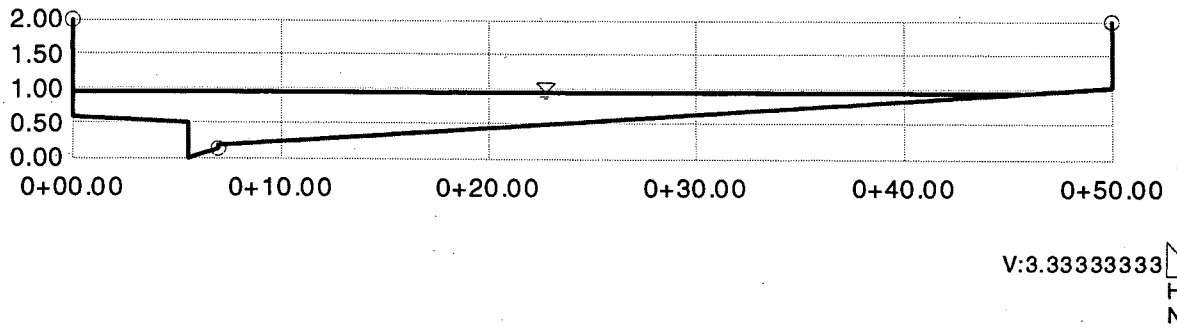
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+43.00	0.89
0+50.00	1.03
0+50.00	2.00

VELOCITY ESTIMATE EX1B
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX1B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Water Surface Elevation	0.94	ft
Elevation Range	0.00 to 2.00	
Discharge	108.00	cfs



PBS&J
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666
Project Engineer: Post, Buckley, Schuh & Jernigan, Inc.

VELOCITY ESTIMATE EX2B
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX2B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

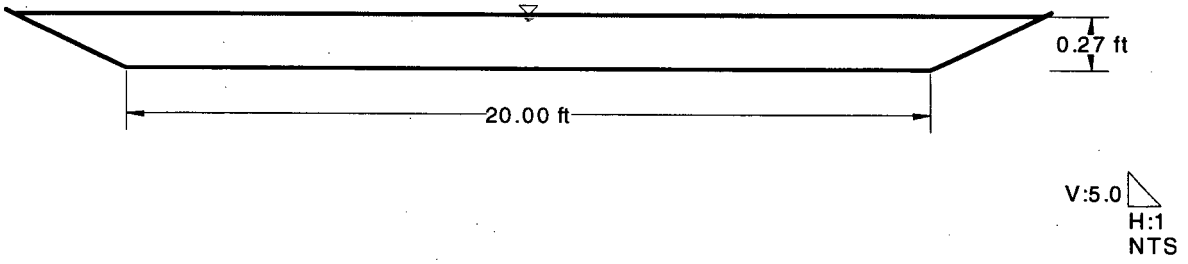
Input Data		
Mannings Coefficient	0.017	
Slope	1.1000	%
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	22.00	cfs

Results		
Depth	0.27	ft
Flow Area	6.2	ft²
Wetted Perimeter	25.46	ft
Top Width	25.43	ft
Critical Depth	0.32	ft
Critical Slope	0.6456	%
Velocity	3.56	ft/s
Velocity Head	0.20	ft
Specific Energy	0.47	ft
Froude Number	1.28	
Flow Type	Supercritical	

VELOCITY ESTIMATE EX2B
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX2B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.1000	%
Depth	0.27	ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	22.00	cfs



VELOCITY ESTIMATE EX3B
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX3B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

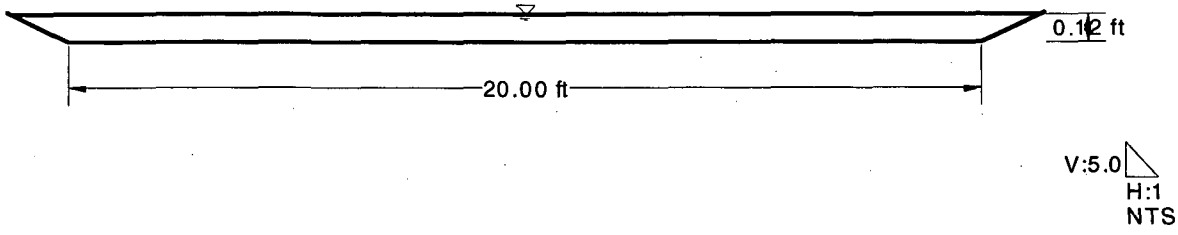
Input Data		
Mannings Coefficient	0.017	
Slope	1.2000	%
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	6.00	cfs

Results		
Depth	0.12	ft
Flow Area	2.6	ft²
Wetted Perimeter	22.48	ft
Top Width	22.47	ft
Critical Depth	0.14	ft
Critical Slope	0.8335	%
Velocity	2.29	ft/s
Velocity Head	0.08	ft
Specific Energy	0.20	ft
Froude Number	1.18	
Flow Type	*Supercritical*	

VELOCITY ESTIMATE EX3B
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX3B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.2000	%
Depth	0.12	ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	6.00	cfs



VELOCITY ESTIMATE EX4B
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX4B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

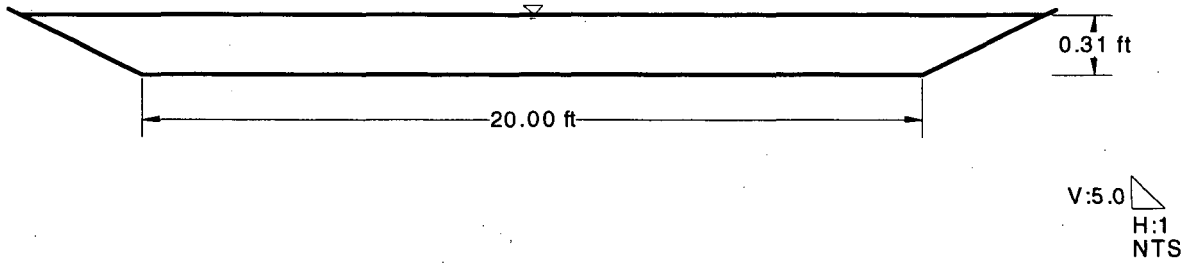
Input Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	32.00	cfs

Results		
Depth	0.31	ft
Flow Area	7.1	ft²
Wetted Perimeter	26.20	ft
Top Width	26.17	ft
Critical Depth	0.40	ft
Critical Slope	0.6024	%
Velocity	4.49	ft/s
Velocity Head	0.31	ft
Specific Energy	0.62	ft
Froude Number	1.52	
Flow Type	Supercritical	

VELOCITY ESTIMATE EX4B
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX4B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Depth	0.31	ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	32.00	cfs



VELOCITY ESTIMATE EX5B
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX5B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

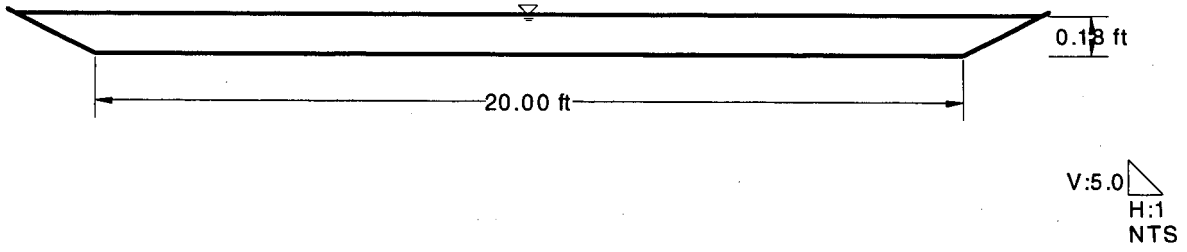
Input Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	13.00	cfs

Results		
Depth	0.18	ft
Flow Area	4.0	ft²
Wetted Perimeter	23.67	ft
Top Width	23.65	ft
Critical Depth	0.23	ft
Critical Slope	0.7141	%
Velocity	3.26	ft/s
Velocity Head	0.17	ft
Specific Energy	0.35	ft
Froude Number	1.40	
Flow Type	Supercritical	

VELOCITY ESTIMATE EX5B
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX5B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Depth	0.18	ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	13.00	cfs



VELOCITY ESTIMATE EX6B
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX6B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.7500	%
Discharge	11.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 2.00	
Flow Area	4.4	ft²
Wetted Perimeter	23.63	ft
Top Width	23.08	ft
Actual Depth	0.55	ft
Critical Elevation	0.55	ft
Critical Slope	0.7211	%
Velocity	2.52	ft/s
Velocity Head	0.10	ft
Specific Energy	0.65	ft
Froude Number	1.02	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+50.00	0.017

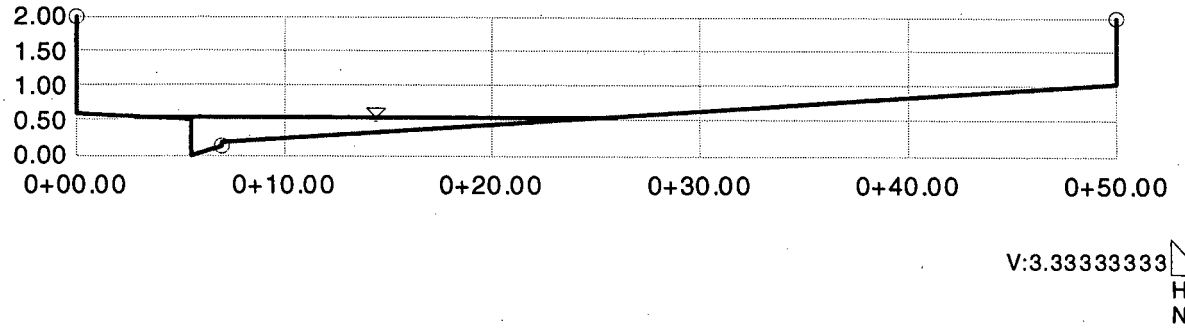
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+43.00	0.89
0+50.00	1.03
0+50.00	2.00

VELOCITY ESTIMATE EX6B
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX6B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	0.7500	%
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 2.00	
Discharge	11.00	cfs



VELOCITY ESTIMATE EX7B
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX7B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

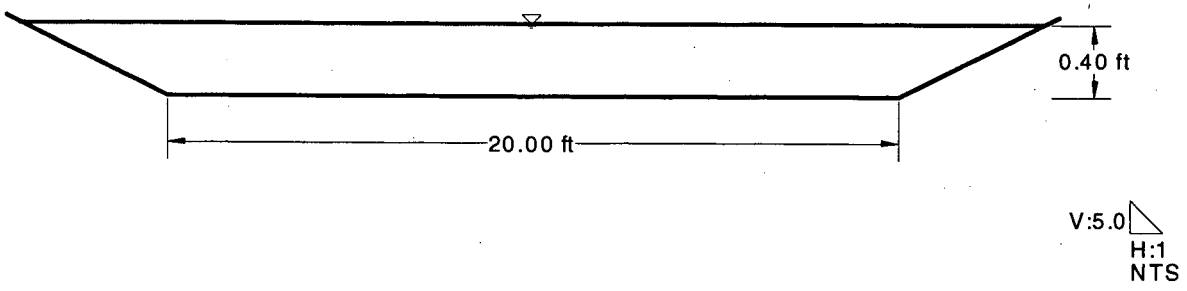
Input Data		
Mannings Coefficient	0.017	
Slope	1.3700	%
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	48.00	cfs

Results		
Depth	0.40	ft
Flow Area	9.6	ft^2
Wetted Perimeter	28.03	ft
Top Width	27.99	ft
Critical Depth	0.51	ft
Critical Slope	0.5604	%
Velocity	5.00	ft/s
Velocity Head	0.39	ft
Specific Energy	0.79	ft
Froude Number	1.51	
Flow Type	Supercritical	

VELOCITY ESTIMATE EX7B
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX7B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.3700	%
Depth	0.40	ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	48.00	cfs



VELOCITY ESTIMATE EX8B
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX8B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

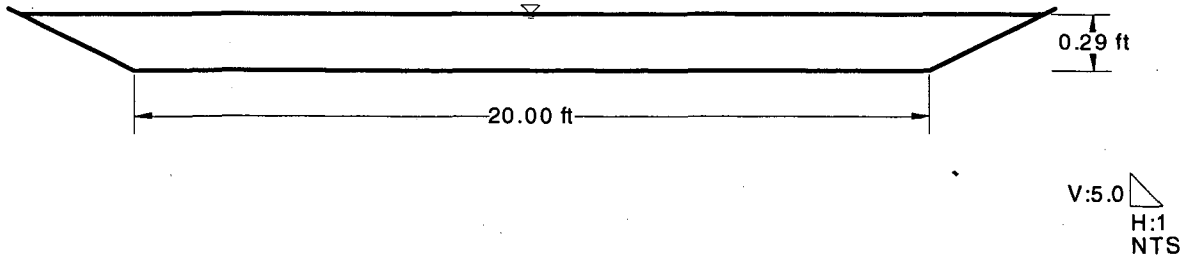
Input Data		
Mannings Coefficient	0.025	
Slope	2.0000	%
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	22.00	cfs

Results		
Depth	0.29	ft
Flow Area	6.5	ft²
Wetted Perimeter	25.74	ft
Top Width	25.71	ft
Critical Depth	0.32	ft
Critical Slope	1.3963	%
Velocity	3.37	ft/s
Velocity Head	0.18	ft
Specific Energy	0.46	ft
Froude Number	1.18	
Flow Type	Supercritical	

VELOCITY ESTIMATE EX8B
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX8B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.025	
Slope	2.0000	%
Depth	0.29	ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	20.00	ft
Discharge	22.00	cfs



GRAPHIC SCALE

600 0 300 600 1200 2400

(IN FEET)

1 inch = 600 ft.

FIGURE B: AREA B DRAINAGE MAP

Floodzone

Basin Flow Summary

EXISTING CONDITION

BASIN / COMB PT ID	BASIN AREA (acres)	Q_{10} (cfs)	Q_{100} (cfs)	VELOCITY (fps)
EX1B	54.8	46	108	5.9
EX2B	9.3	9	22	3.6
EX3B	2.3	2	6	2.3
EX4B	11.4	15	32	4.5
EX5B	4.7	6	13	3.3
EX6B	3.5	6	11	2.5
EX7B	19.3	20	48	5.0
EX8B	17.7	6	22	3.4
C1*	NA	78	180	NA
C2*	NA	24	67	NA

*Assumes no flow removed by existing drop inlets

Actual C1 - 100-Year flow in Warm Springs after drop inlet removal and flow split at Section B-B = 87 cfs

Actual C2 - 100-Year flow discharging to golf course including drop inlet removal & Area A = 149cfs

Flow in Green Valley Pkwy, assuming drop inlet removal, at Section A-A = 24 cfs

LEGEND

EX1B	Basin Name
	Basin Boundary
	Flow Arrow
A	Cross-Section
C1	Combination Point
	Local Pipe
DI	Drop Inlet

N

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE B

AREA C

HEC-1 Analysis & Figure C

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

PBS&J, Inc. **DEVELOPMENT:** **AREA C**

Project No. : **511542.00**

File: STDRFRM4.XLS **CALCULATED BY :** **BKL** **DATE:** **October, 2003**

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc CHECK URBANIZED BASINS		FINAL Tc	Tlag	REMARKS
DESIG:	CN	K	AREA (acres)	AREA (mi^2)	LENGTH (ft)	SLOPE (%)	Ti (min)	LENGTH (ft)	SLOPE (%)	LAND COVER k	VELOCITY* (fps)	Tt (min)	Tc = Ti + Tt (min)	TOTAL LENGTH (ft)	Tc = (L/180)+10 (min)	Tc = (min)	Tlag= 0.6Tc/60 (hrs)	Q_{100}/Q_{10} (cfs)
(1)		(2)	(3)		(4)	(5)	(6)	(7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)		
EX1C	89.0	0.785	22.3	0.0348	150	1.0	6.9	1500	1.7	NA	4.61	5.4	12.4	1650	19.2	12.4	**0.124**	

Tc = Ti + Tt Ti = 1.8 (1.1 - K) L^1/2 / S^1/3

Tlag = 0.6Tc K = 0.0132 (CN) - 0.39

* The velocity in column 9 is based on approximate channel properties.

REFERENCE :

STANDARD FORM 4

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   26FEB04  TIME  10:16:23   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
             1      ID  ************************************
             2      ID      File: AREAC.DAT                *
             3      ID      OCTOBER 2003                   *
             4      ID                                     *
             5      ID      UPRR FIS                       *
             6      ID      EXISTING DRAINAGE CONDITIONS   *
             7      ID                                     *
             8      ID  ************************************
             9      ID
                    *DIAGRAM
*** FREE ***
            10      IT       3       0       0     300
            11      IO       5       0       0
            12      IN       5       0       0
            13      JR    PREC    0.57    1.00
                    *
            14      KK    EX1C
            15      KM   EXISTING RESIDENTIAL BASIN
            16      BA  0.0348
            17      PB    2.77
            18      PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
            19      PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
            20      PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
            21      PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
            22      PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
            23      PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
            24      PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
            25      PC    .998    .999   1.00
            26      LS       0      89
            27      UD   0.124
                    *
            28      ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    14       EX1C

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```


```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   26FEB04  TIME  10:16:23   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```


```
************************************
   File: AREAC.DAT                *
   OCTOBER 2003                   *
```

```
                                                                          *
                                  UPRR FIS                                *
                                  EXISTING DRAINAGE CONDITIONS            *
                                                                          *
                              ***************************************

  11 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           3  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1    0  ENDING DATE
                      NDTIME        1457  ENDING TIME
                       ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   14.95 HOURS

            ENGLISH UNITS
                 DRAINAGE AREA          SQUARE MILES
                 PRECIPITATION DEPTH    INCHES
                 LENGTH, ELEVATION      FEET
                 FLOW                   CUBIC FEET PER SECOND
                 STORAGE VOLUME         ACRE-FEET
                 SURFACE AREA           ACRES
                 TEMPERATURE            DEGREES FAHRENHEIT

     JP          MULTI-PLAN OPTION
                       NPLAN           1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
                   RATIOS OF PRECIPITATION
                     .57     1.00
1

              PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                                TIME TO PEAK IN HOURS


                                                                 RATIOS APPLIED TO PRECIPITATION
 OPERATION        STATION     AREA    PLAN                 RATIO 1  RATIO 2
                                                               .57     1.00

 HYDROGRAPH AT
+                    EX1C         .03     1   FLOW             23.      53.
                                              TIME            3.55     3.55


*** NORMAL END OF HEC-1 ***
```

VELOCITY ESTIMATE FOR EX1C
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX1D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.7000	%
Discharge	53.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.54	ft
Elevation Range	0.00 to 2.00	
Flow Area	11.5	ft²
Wetted Perimeter	46.44	ft
Top Width	45.74	ft
Actual Depth	0.54	ft
Critical Elevation	0.64	ft
Critical Slope	0.5882	%
Velocity	4.61	ft/s
Velocity Head	0.33	ft
Specific Energy	0.87	ft
Froude Number	1.62	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50

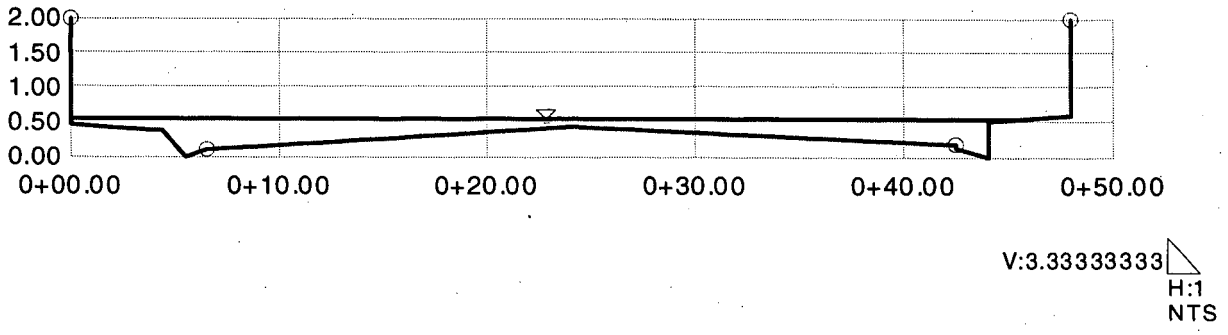
VELOCITY ESTIMATE FOR EX1C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+48.00	0.60
0+48.00	2.00

VELOCITY ESTIMATE FOR EX1C
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX1D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.7000	%
Water Surface Elevation	0.54	ft
Elevation Range	0.00 to 2.00	
Discharge	53.00	cfs



Basin Flow Summary
EXISTING CONDITION

BASIN / COMB PT ID	BASIN AREA (acres)	Q_{10} (cfs)	Q_{100} (cfs)	VELOCITY (fps)
EX1C	22.3	23	53	4.61

LEGEND

EX1C	Basin Name
———	Basin Boundary
→	Flow Arrow
—(A)—	Cross-Section
———	Local Pipe

N

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)

1 inch = 400 ft.

FIGURE C: AREA C DRAINAGE MAP

Floodzone

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE C

AREA D

HEC-1 Analysis & Figure D

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

PBS&J, Inc. **DEVELOPMENT:** **AREA D**
Project No. : **511542.00**
File: STDRFRM4.XLS **CALCULATED BY :** **BKL** **DATE:** **NOVEMBER, 2003**

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc CHECK URBANIZED BASINS		FINAL Tc	Tlag	REMARKS
DESIG: (1)	CN	K (2)	AREA (acres) (3)	AREA (mi^2)	LENGTH (ft) (4)	SLOPE (%) (5)	Ti (min) (6)	LENGTH (ft) (7)	SLOPE (%) (8)	LAND COVER k	VELOCITY* (fps) (9)	Tt (min) (10)	Tc = Ti + Tt (min) (11)	TOTAL LENGTH (ft) (12)	Tc = (L/180)+10 (min) (13)	Tc = (min) (14)	Tlag= 0.6Tc/60 (hrs)	Q_{100}/Q_{10} (cfs)
EX1D	84.5	0.725	16.5	0.0258	100	2.0	5.4	2500	1.50	NA	3.6	11.5	16.9	2600	24.4	16.9	**0.169**	
EX2D	87.5	0.765	12.8	0.0200	100	2.0	4.8	1200	1.50	NA	3.6	5.5	10.3	1300	17.2	10.3	**0.103**	
EX3D	87.5	0.765	12.3	0.0192	100	2.0	4.8	1200	1.50	NA	3.6	5.6	10.4	1300	17.2	10.4	**0.104**	
EX4D	87.5	0.765	22.3	0.0348	100	2.0	4.8	1400	1.50	NA	4.4	5.3	10.1	1500	18.3	10.1	**0.101**	
EX5D	87.5	0.765	24.0	0.0375	75	2.0	4.1	1500	1.50	NA	4.6	5.5	9.6	1575	18.8	9.6	**0.096**	
EX6D	94.0	0.851	7.0	0.0109	75	2.0	3.1	1000	1.50	NA	3.2	5.2	8.2	1075	16.0	8.2	**0.082**	
EX7D	93.0	0.838	8.3	0.0130	75	1.5	3.6	1000	3.00	NA	3.5	4.7	8.3	1075	16.0	8.3	**0.083**	

Tc = Ti + Tt Ti = 1.8 (1.1 - K) L^1/2 / S^1/3

Tlag = 0.6Tc K = 0.0132 (CN) - 0.39

*** The velocity in column 9 is based on approximate channel properties.**

REFERENCE :

STANDARD FORM 4

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   01APR04  TIME  07:24:41  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
            1       ID  ************************************
            2       ID       File: AREAD.DAT                *
            3       ID       OCTOBER 2003                   *
            4       ID                                      *
            5       ID       UPRR FIS                       *
            6       ID       EXISTING DRAINAGE CONDITIONS   *
            7       ID                                      *
            8       ID  ************************************
            9       ID
                    *DIAGRAM
*** FREE ***
           10       IT       3       0       0     300
           11       IO       5       0       0
           12       IN       5       0       0
           13       JR    PREC    0.57    1.00
                    *
           14       KK     EX5D
           15       KM    EXISTING RESIDENTIAL/COMMERCIAL BASIN
           16       BA  0.0375
           17       PB    2.77
           18       PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           19       PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           20       PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           21       PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           22       PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           23       PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           24       PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           25       PC    .998    .999   1.00
           26       LS       0    87.5
           27       UD   0.096
                    *
           28       KK     EX1D
           29       KM    EXISTING RESIDENTIAL BASIN
           30       BA  0.0258
           31       LS       0    84.5
           32       UD   0.169
                    *
           33       KK     EX6D
           34       KM    EXISTING COMMERCIAL
           35       BA  0.0109
           36       LS       0      94
           37       UD   0.082
                    *
           38       KK      C1
           39       KM    COMBINE BASINS EX1D EX6D AND EX5D
           40       HC       3
                    *
```

1 HEC-1 INPUT PAGE 2

```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
           41       KK     EX2D
           42       KM    EXISTING RESIDENTIAL BASIN
           43       BA  0.0200
           44       LS       0    87.5
```

```
            45          UD   0.103
                        *

            46          KK    EX3D
            47          KM   EXISTING RESIDENTIAL BASIN
            48          BA  0.0192
            49          LS       0    87.5
            50          UD   0.104
                        *

            51          KK      C2
            52          KM   COMBINE BASINS EX2D AND EX3D
            53          HC       2
                        *

            54          KK    EX4D
            55          KM   EXISTING RESIDENTIAL BASIN
            56          BA  0.0348
            57          LS       0    87.5
            58          UD   0.101
                        *

            59          KK    EX7D
            60          KM   EXISTING APARTMENT COMPLEX
            61          BA  0.0130
            62          LS       0      93
            63          UD   0.083
                        *
            64          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING           (---->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR         (<----) RETURN OF DIVERTED OR PUMPED FLOW

    14       EX5D
                .
                .
    28          .         EX1D
                .           .
                .           .
    33          .           .         EX6D
                .           .           .
                .           .           .
    38         C1.....................
                .
                .
    41          .         EX2D
                .           .
                .           .
    46          .           .         EX3D
                .           .           .
                .           .           .
    51          .          C2.............
                .           .
                .           .
    54          .           .         EX4D
                .           .           .
                .           .           .
    59          .           .           .         EX7D

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   01APR04  TIME  07:24:41  *
*                                      *
****************************************

****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*        DAVIS, CALIFORNIA 95616       *
*          (916) 756-1104              *
*                                      *
****************************************

                        ************************************
                            File: AREAD.DAT                 *
                            OCTOBER 2003                    *
                                                            *
                            UPRR FIS                        *
                            EXISTING DRAINAGE CONDITIONS    *
                                                            *
                        ************************************

    11 IO          OUTPUT CONTROL VARIABLES
                         IPRNT          5  PRINT CONTROL
                         IPLOT          0  PLOT CONTROL
                         QSCAL          0.  HYDROGRAPH PLOT SCALE

       IT          HYDROGRAPH TIME DATA
                          NMIN          3  MINUTES IN COMPUTATION INTERVAL
                         IDATE      1    0  STARTING DATE
                         ITIME         0000  STARTING TIME
                            NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                        NDDATE      1    0  ENDING DATE
```

NDTIME 1457 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .05 HOURS
TOTAL TIME BASE 14.95 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	EX5D	.04	1	FLOW	24.	58.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX1D	.03	1	FLOW	11.	30.
				TIME	3.60	3.60
HYDROGRAPH AT						
+	EX6D	.01	1	FLOW	11.	21.
				TIME	3.50	3.50
3 COMBINED AT						
+	C1	.07	1	FLOW	44.	107.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX2D	.02	1	FLOW	12.	30.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX3D	.02	1	FLOW	12.	29.
				TIME	3.55	3.55
2 COMBINED AT						
+	C2	.04	1	FLOW	24.	60.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX4D	.03	1	FLOW	22.	53.
				TIME	3.55	3.55
HYDROGRAPH AT						
+	EX7D	.01	1	FLOW	12.	24.
				TIME	3.55	3.50

*** NORMAL END OF HEC-1 ***

VELOCITY ESTIMATE FOR EX1D
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX1E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	73.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.61	ft
Elevation Range	0.00 to 2.00	
Flow Area	14.6	ft²
Wetted Perimeter	48.78	ft
Top Width	48.00	ft
Actual Depth	0.61	ft
Critical Elevation	0.72	ft
Critical Slope	0.5374	%
Velocity	4.99	ft/s
Velocity Head	0.39	ft
Specific Energy	1.00	ft
Froude Number	1.59	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50

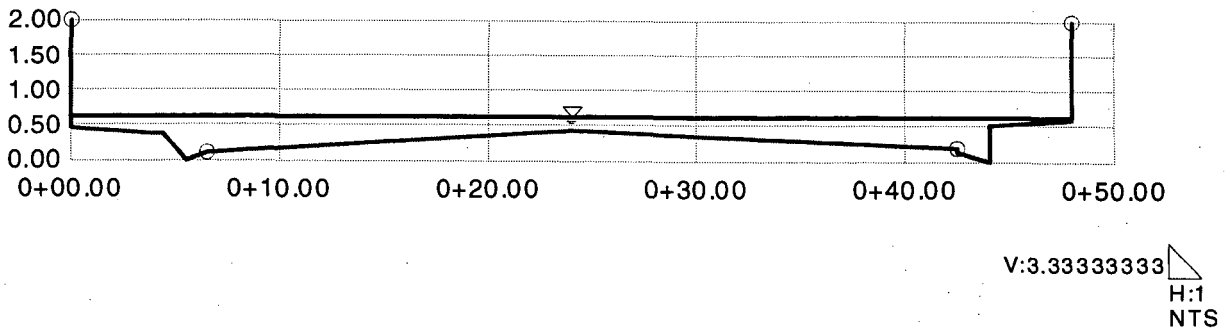
VELOCITY ESTIMATE FOR EX1D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+48.00	0.60
0+48.00	2.00

VELOCITY ESTIMATE FOR EX1D
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX1E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Slope	1.5000	%
Water Surface Elevation	0.61	ft
Elevation Range	0.00 to 2.00	
Discharge	73.00	cfs



VELOCITY ESTIMATE FOR EX2D
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX2E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	30.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.47	ft
Elevation Range	0.00 to 2.00	
Flow Area	8.3	ft²
Wetted Perimeter	44.60	ft
Top Width	44.00	ft
Actual Depth	0.47	ft
Critical Elevation	0.53	ft
Critical Slope	0.6400	%
Velocity	3.62	ft/s
Velocity Head	0.20	ft
Specific Energy	0.68	ft
Froude Number	1.47	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50

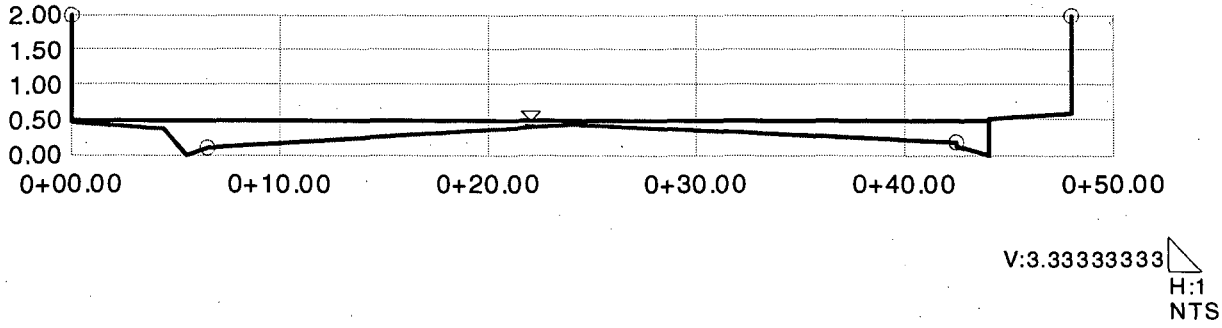
VELOCITY ESTIMATE FOR EX2D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+48.00	0.60
0+48.00	2.00

VELOCITY ESTIMATE FOR EX2D
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX2E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Slope	1.5000	%
Water Surface Elevation	0.47	ft
Elevation Range	0.00 to 2.00	
Discharge	30.00	cfs



VELOCITY ESTIMATE FOR EX3D
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX3E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	29.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.47	ft
Elevation Range	0.00 to 2.00	
Flow Area	8.1	ft²
Wetted Perimeter	44.59	ft
Top Width	44.00	ft
Actual Depth	0.47	ft
Critical Elevation	0.52	ft
Critical Slope	0.6430	%
Velocity	3.58	ft/s
Velocity Head	0.20	ft
Specific Energy	0.67	ft
Froude Number	1.47	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50

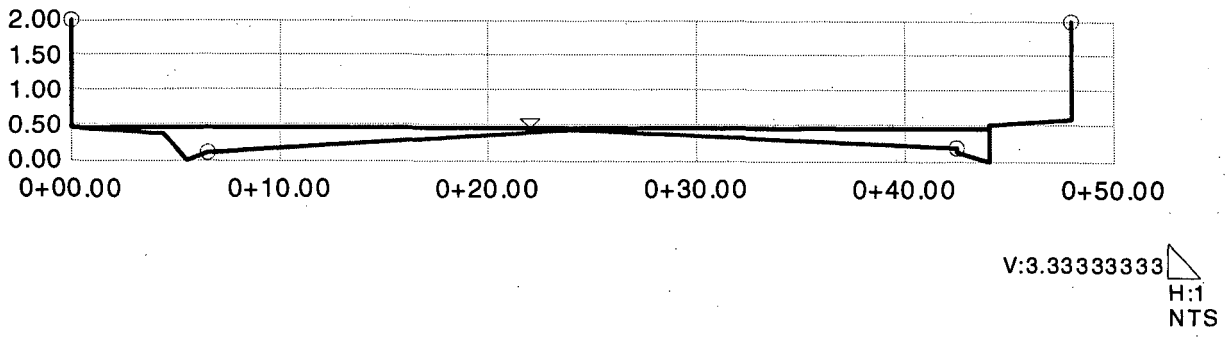
VELOCITY ESTIMATE FOR EX3D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+48.00	0.60
0+48.00	2.00

VELOCITY ESTIMATE FOR EX3D
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX3E
Flow Element	*Irregular Channel*
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Slope	1.5000	%
Water Surface Elevation	0.47	ft
Elevation Range	0.00 to 2.00	
Discharge	29.00	cfs



VELOCITY ESTIMATE FOR EX4D
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX4E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	53.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 2.00	
Flow Area	12.0	ft²
Wetted Perimeter	46.86	ft
Top Width	46.15	ft
Actual Depth	0.55	ft
Critical Elevation	0.64	ft
Critical Slope	0.5863	%
Velocity	4.43	ft/s
Velocity Head	0.31	ft
Specific Energy	0.86	ft
Froude Number	1.53	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50

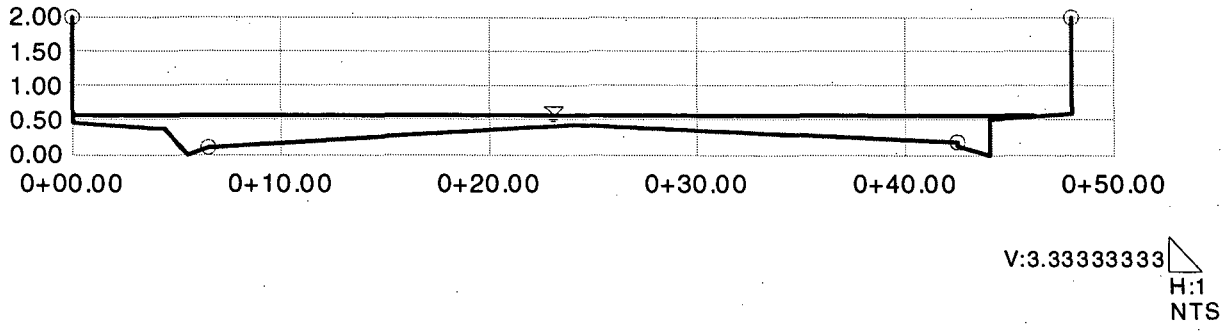
VELOCITY ESTIMATE FOR EX4D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+48.00	0.60
0+48.00	2.00

VELOCITY ESTIMATE FOR EX4D
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX4E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 2.00	
Discharge	53.00	cfs



VELOCITY ESTIMATE FOR EX5D
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX5E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	58.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.57	ft
Elevation Range	0.00 to 2.00	
Flow Area	12.7	ft²
Wetted Perimeter	47.49	ft
Top Width	46.76	ft
Actual Depth	0.57	ft
Critical Elevation	0.66	ft
Critical Slope	0.5717	%
Velocity	4.58	ft/s
Velocity Head	0.33	ft
Specific Energy	0.89	ft
Froude Number	1.55	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50

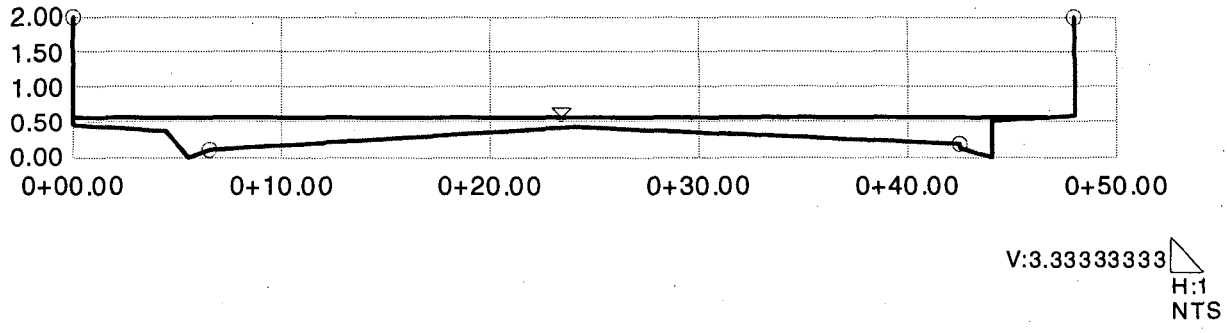
VELOCITY ESTIMATE FOR EX5D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+48.00	0.60
0+48.00	2.00

VELOCITY ESTIMATE FOR EX5D
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX5E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Slope	1.5000	%
Water Surface Elevation	0.57	ft
Elevation Range	0.00 to 2.00	
Discharge	58.00	cfs



VELOCITY ESTIMATE FOR EX6D
Worksheet for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX6E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	21.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.43	ft
Elevation Range	0.00 to 2.00	
Flow Area	6.5	ft²
Wetted Perimeter	41.88	ft
Top Width	41.33	ft
Actual Depth	0.43	ft
Critical Elevation	0.48	ft
Critical Slope	0.6782	%
Velocity	3.23	ft/s
Velocity Head	0.16	ft
Specific Energy	0.59	ft
Froude Number	1.44	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17

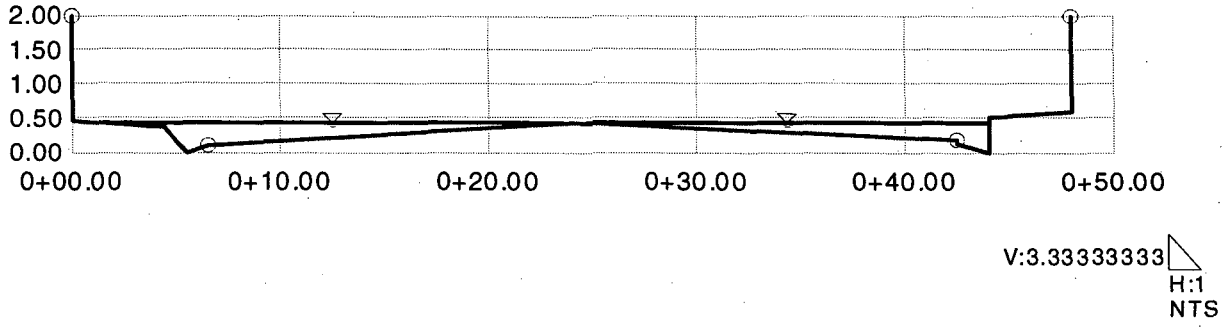
VELOCITY ESTIMATE FOR EX6D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50
0+48.00	0.60
0+48.00	2.00

VELOCITY ESTIMATE FOR EX6D
Cross Section for Irregular Channel

Project Description	
Worksheet	VELOCITY ESTIMATE FOR EX6E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Slope	1.5000	%
Water Surface Elevation	0.43	ft
Elevation Range	0.00 to 2.00	
Discharge	21.00	cfs



VELOCITY ESTIMATE EX7D
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX7E
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

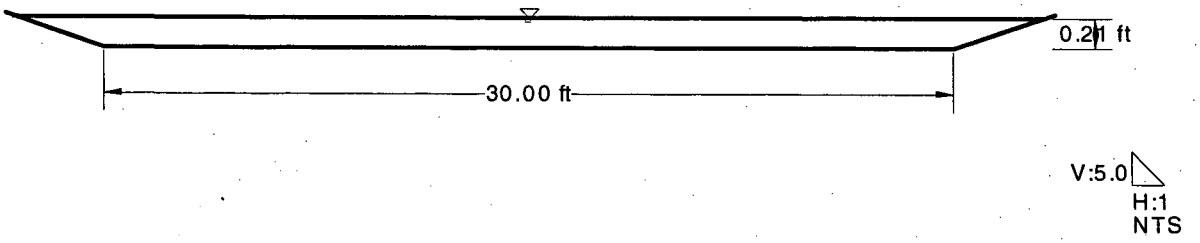
Input Data		
Mannings Coefficient	0.030	
Slope	4.5000	%
Left Side Slope	15.00	H : V
Right Side Slope	15.00	H : V
Bottom Width	30.00	ft
Discharge	25.00	cfs

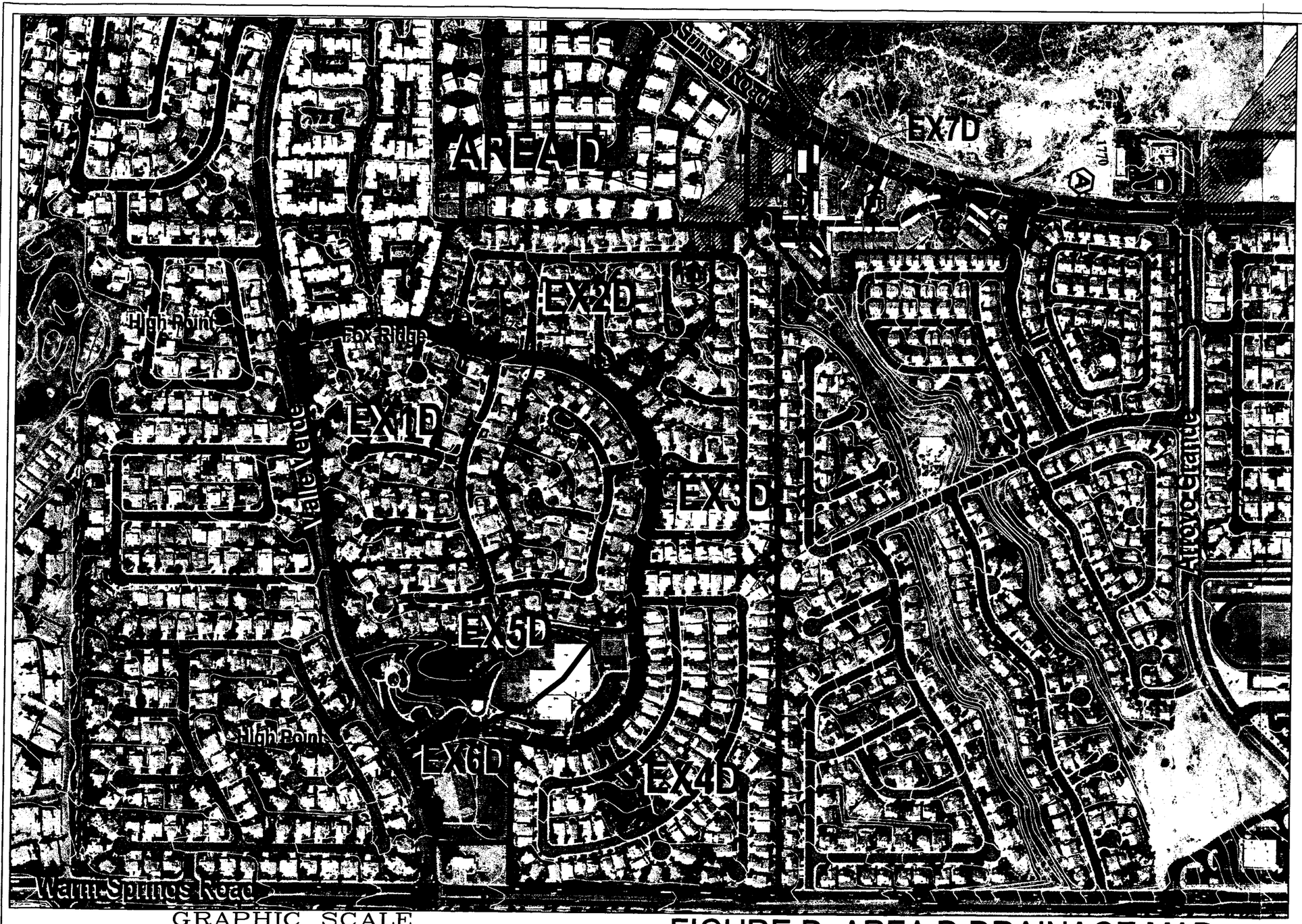
Results		
Depth	0.21	ft
Flow Area	7.1	ft²
Wetted Perimeter	36.42	ft
Top Width	36.40	ft
Critical Depth	0.27	ft
Critical Slope	2.1177	%
Velocity	3.53	ft/s
Velocity Head	0.19	ft
Specific Energy	0.41	ft
Froude Number	1.41	
Flow Type	Supercritical	

VELOCITY ESTIMATE EX7D
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	VELOCITY ESTIMATE EX7E
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Slope	4.5000	%
Depth	0.21	ft
Left Side Slope	15.00	H : V
Right Side Slope	15.00	H : V
Bottom Width	30.00	ft
Discharge	25.00	cfs





Basin Flow Summary
EXISTING CONDITION

BASIN / COMB PT ID	BASIN AREA (acres)	Q_{100} (cfs)	VELOCITY (fps)
EX1D	16.5	30	3.6
EX2D	12.8	30	3.6
EX3D	12.3	29	3.6
EX4D	22.3	53	4.4
EX5D	24	58	4.6
EX6D	7	21	3.2
EX7D	7	25	3.2
C1	na	107	na
C2	na	221	na
C3	na	231	na

LEGEND

EX1D — Basin Name

——— Basin Boundary

→ Flow Arrow

—(A)— Cross-Section

N

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)

1 inch = 400 ft.

FIGURE D: AREA D DRAINAGE MAP
Current Effective Floodzone Delineations

▨ Floodzone

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE D

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)

1 inch = 400 ft.

FIGURE D1: AREA D DRAINAGE MAP

Proposed Floodzone Delineation Workmap

Floodzone

N

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE D1

APPENDIX D
Hydraulics

AREA A

Flowmaster Cross-Sections

DEPTH CALCULATION FOR CROSS SECTION A-A
Worksheet for Irregular Channel

Project Description	
Worksheet	DEPTH CALCULATION FOR CROSS SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	3.2000	%
Discharge	18.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.36	ft
Elevation Range	0.00 to 1.00	
Flow Area	4.0	ft²
Wetted Perimeter	30.72	ft
Top Width	30.25	ft
Actual Depth	0.36	ft
Critical Elevation	0.46	ft
Critical Slope	0.6371	%
Velocity	4.45	ft/s
Velocity Head	0.31	ft
Specific Energy	0.67	ft
Froude Number	2.14	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00

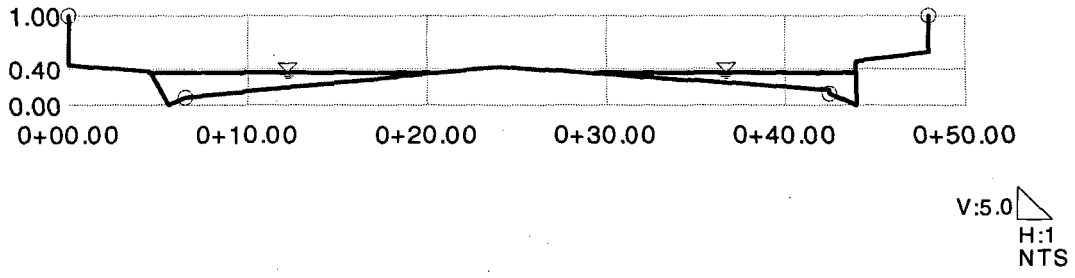
DEPTH CALCULATION FOR CROSS SECTION A-A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50
0+48.00	0.60
0+48.00	1.00

DEPTH CALCULATION FOR CROSS SECTION A-A
Cross Section for Irregular Channel

Project Description	
Worksheet	DEPTH CALCULATION FOR CROSS SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.015	
Slope	3.2000	%
Water Surface Elevation	0.36	ft
Elevation Range	0.00 to 1.00	
Discharge	18.00	cfs



DEPTH CALCULTION FOR CROSS SECTION B-B
Worksheet for Irregular Channel

Project Description	
Worksheet	DEPTH CALCULATION FOR CROSS-SECTION B-B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	2.6000	%
Discharge	7.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.025	
Water Surface Elevation	1,985.09	ft
Elevation Range	1,985.00 to 1,995.00	
Flow Area	3.6	ft²
Wetted Perimeter	38.99	ft
Top Width	38.97	ft
Actual Depth	0.09	ft
Critical Elevation	1,985.10	ft
Critical Slope	1.9638	%
Velocity	1.95	ft/s
Velocity Head	0.06	ft
Specific Energy	1,985.15	ft
Froude Number	1.13	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	1+30.00	0.025

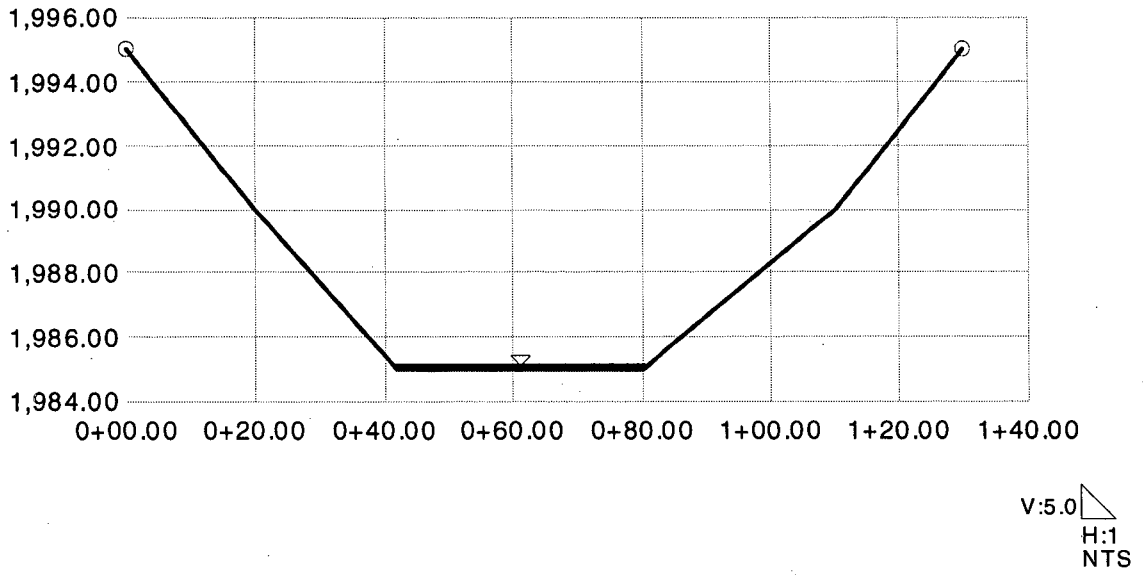
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1,995.00
0+20.00	1,990.00
0+42.00	1,985.00
0+80.00	1,985.00
1+10.00	1,990.00
1+30.00	1,995.00

DEPTH CALCULATION FOR CROSS SECTION B-B
Cross Section for Irregular Channel

Project Description	
Worksheet	DEPTH CALCULATION FOR CROSS-SECTION B-B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

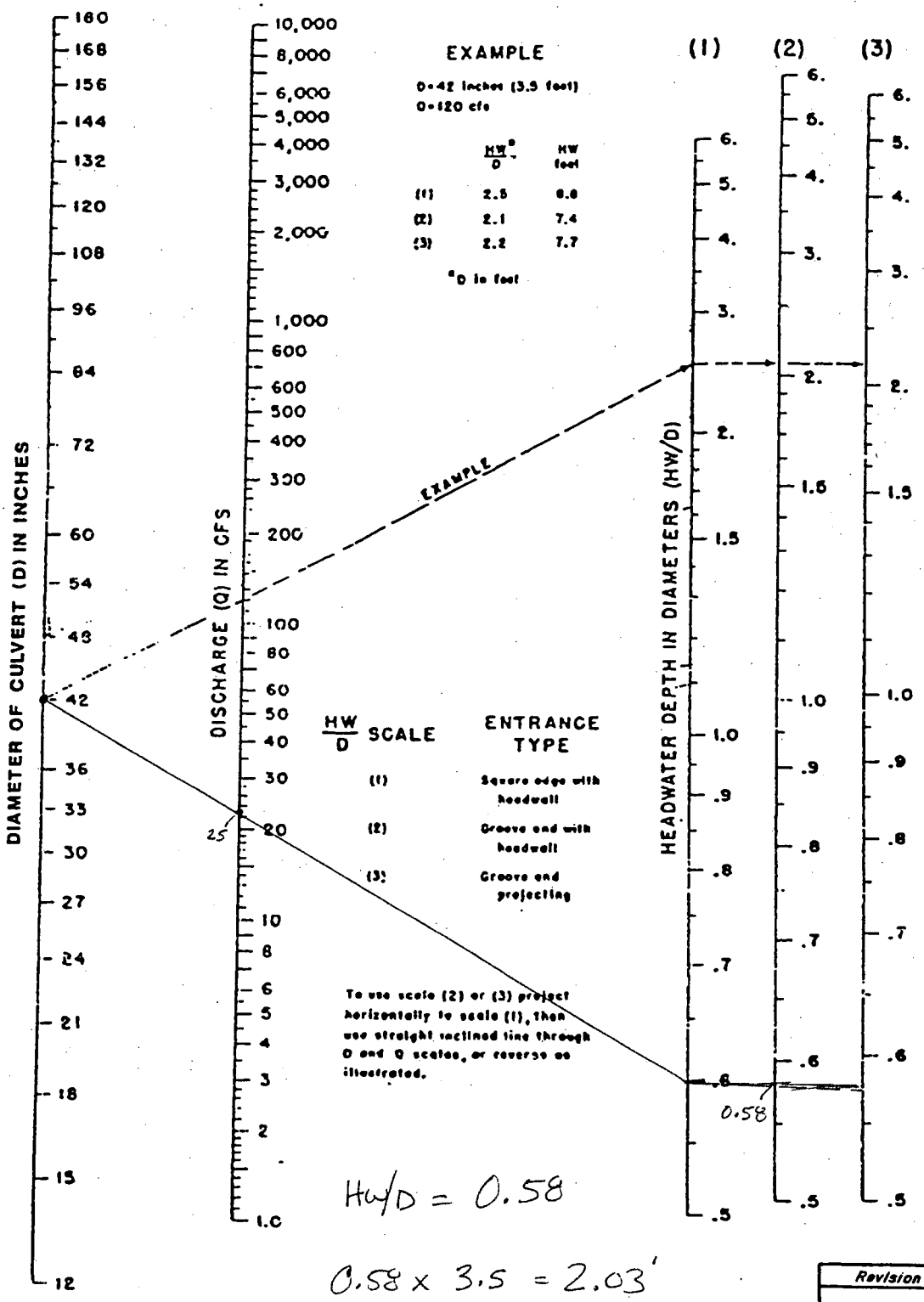
Section Data		
Mannings Coefficient	0.025	
Slope	2.6000	%
Water Surface Elevation	1,985.09	ft
Elevation Range	1,985.00 to 1,995.00	
Discharge	7.00	cfs



42" RCP Calculation for Area A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH – INLET CONTROL RCP



Revision	Date

WRC ENGINEERING	REFERENCE: USDOT, FHWA, HDS, No. 5, 1985	FIGURE 1005

AREA B

Flowmaster Cross-Sections

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Sag
Date: 11/18/2003

Project No. :511542.00
Project Name.:UPRR AREA LOMR
Computed by :BKL

Project Description
Drop Inlet Calculation for Sump Condition (total flow=38cfs)
Commercial Complex at SWC of Warm Springs and GVP
Flow = 19 cfs or 1/2 flow for each of 2 inlets

Inlets on Sag: Equal-Length Combination Inlet

Roadway and Discharge Data

	Cross Slope	Composite/Dep
Sx	Pavement Cross Slope (ft/ft)	0.0200
Sw	Gutter Cross Slope (ft/ft)	0.0875
n	Manning's Coefficient	0.016
W	Gutter Width (ft)	1.50
a	Gutter Depression (inch)	2.00

Inlet Interception

	Inlet Type *Sag*	Curb-Opening
L	Curb-Opening Length (ft)	6.00
H	Curb-Opening Height (in)	6.00
	Inlet Type *Sag*	**Parallel Bar P-1-1/8**
T	Width of Spread (ft)	21.30
WGR	Grate Width (ft)	6.00
L	Grate Length (ft)	6.00
	Inlet Type *Sag*	**Equal Length Combination**
d_ave	Depth of Flow (ft)	0.545
d_curb	Depth at Curb (ft)	0.694 → acceptable, less than 1' of ponding
Qi	Intercepted Flow (cfs)	19.000

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Sag
Date: 11/18/2003

Project No. :511542.00
Project Name.:UPRR AREA LOMR
Computed by :BKL

Project Description
Drop Inlet CAlculation for Sump Condition
Existing Apartment Complex
Flow = 22 cfs

Inlets on Sag: Equal-Length Combination Inlet

Roadway and Discharge Data

	Cross Slope		Composite/Dep
Sx	Pavement Cross Slope	(ft/ft)	0.0200
Sw	Gutter Cross Slope	(ft/ft)	0.0875
n	Manning's Coefficient		0.016
W	Gutter Width (ft)		1.50
a	Gutter Depression (inch)		2.00

Inlet Interception

	Inlet Type *Sag*	Curb-Opening
L	Curb-Opening Length (ft)	6.00
H	Curb-Opening Height (in)	6.00

	Inlet Type *Sag*	Parallel Bar P-1-1/8
T	Width of Spread (ft)	22.56
WGR	Grate Width (ft)	6.00
L	Grate Length (ft)	6.00

	Inlet Type *Sag*	Equal Length Combination
d_ave	Depth of Flow (ft)	0.570
d_curb	Depth at Curb (ft)	0.719 → acceptable, less than 1' of ponding
Qi	Intercepted Flow (cfs)	22.000

FLOW SPLIT Q_{100} — User Input

Calculations from the Pima County Drainage Manual

Project: UPRR Area LOMR

Main Street: Warm Springs — 100 ft ROW

Side Street: Green Valley Pkwy — 100 ft ROW

Main Street Parameters

Total Flow = 108 cfs

Depth of Flow Above Flow Line (Flowmaster) = 0.75 ft

Total Area of Flow (Flowmaster) = 21.4 ft^2

Overbank Area Average Depth of Flow = 0.25 ft

Width of Overbank (sidewalk) = 5.5 ft

Overbank Flow Area = 1.38 ft^2

Overbank Flow (actual) = 6.94 cfs

(velocity from Flowmaster) = 5.05

Main Street Flow = 101.06 cfs

Q_L = Lateral flow into the side street

Q_m = Main street flow measured between the curbs = 101.06 cfs

S_m = Longitudinal slope of the main street = 0.015 ft/ft

W_m = Width of the main street = 89 ft

W_{ss} = Width of the side street = 89 ft

$Q_L = 0.042 [Q_m^{0.93} W_{ss}^{0.85}] / [S_m^{0.41} W_m^{0.79}]$ = 22.5 cfs

***Note: If Q_L is greater than Q_m, Q_L should be set equal to Q_m.**

Q_o = Overland flow intercepted by the side street

y_o = Depth of overbank flow intercepted by the side street = 0.25 cfs

S_s = Longitudinal slope of the side street = 0.0075 ft/ft

$Q_o = [46.8\ y_o W_{ss} S_s^{0.5} - Q_L]$ = 67.7 cfs *

***Note: If Q_o is positive and is greater than the actual overbank flow, it should be assumed that all of the actual overbank flow turns and flows down the side street.**

Q SPLIT

Q_{split} = Overbank Flow (actual) + Q_L = 29 cfs, in the side street

Main street total flow - Q_{split} = 79 cfs, remainder in the main street

FLOW SPLIT Q_{100}

User Input

Calculations from the Pima County Drainage Manual

Project: UPRR Area LOMR

Main Street: Green Valley Pkwy — 100 ft ROW

Side Street: Warm Springs — 100 ft ROW

Main Street Parameters

Total Flow =	24	cfs
Depth of Flow Above Flow Line (Flowmaster) =	0.55	ft
Total Area of Flow (Flowmaster) =	9	ft^2
Overbank Area Average Depth of Flow =	0.05	ft
Width of Overbank (sidewalk) =	5.5	ft
Overbank Flow Area =	0.28	ft^2
Overbank Flow (actual) =	0.73	cfs
(velocity from Flowmaster) = 2.66		
Main Street Flow =	23.27	cfs

Q_L = Laterial flow into the side street

Q_m = Main street flow measured between the curbs =	23.27	cfs
S_m = Longitudinal slope of the main street =	0.0075	ft/ft
W_m = Width of the main street =	89	ft
W_{ss} = Width of the side street =	89	ft
$Q_L = 0.042\ [\ Q_m^{0.93}\ W_{ss}^{0.85}\ ] / [\ S_m^{0.41}\ W_m^{0.79}\ ]$ =	7.6	cfs

*Note: If Q_L is greater than Q_m, Q_L should be set equal to Q_m.

Q_o = Overland flow intercepted by the side street

y_o = Depth of overbank flow intercepted by the side street =	0.05	cfs
S_s = Longitudinal slope of the side street =	0.015	ft/ft
$Q_o = [46.8\ y_o\ W_{ss}\ S_s^{0.5} - Q_L]$ =	17.9	cfs *

* Note: If Q_o is positive and is greater than the actual overbank flow, it should be assumed that all of the actual overbank flow turns and flows down the side street.

Q SPLIT

Q_{split} = Overbank Flow (actual) + Q_L = 8 cfs, in the side street

Main street total flow - Q_{split} = 16 cfs, remainder in the main street

100' ROW WARM SPRINGS CAPACITY CALCULATION (1-FOOT DEEP)
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS CAPACITY CALCULATION (1' DEEP)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	280.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	1.00	ft
Elevation Range	0.00 to 2.00	
Flow Area	41.9	ft²
Wetted Perimeter	88.15	ft
Top Width	86.00	ft
Actual Depth	1.00	ft
Critical Elevation	1.21	ft
Critical Slope	0.4738	%
Velocity	6.69	ft/s
Velocity Head	0.69	ft
Specific Energy	1.70	ft
Froude Number	1.69	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+43.00	0.89
0+43.00	1.39

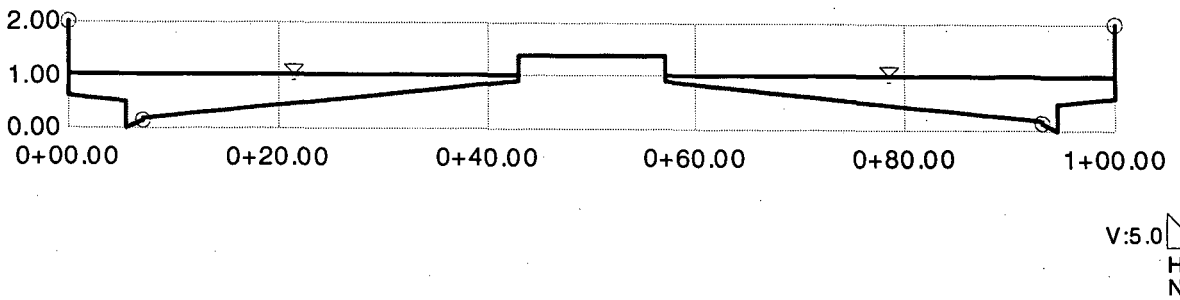
100' ROW WARM SPRINGS CAPACITY CALCULATION (1-FOOT DEEP)
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+57.00	1.39
0+57.00	0.89
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW WARM SPRINGS CAPACITY CALCULATION (1-FOOT DEEP)
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS CAPACITY CALCULATION (1' DEEP)
Flow Element	Irregular Channel
Method	*Manning's Formula*
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Water Surface Elevation	1.00	ft
Elevation Range	0.00 to 2.00	
Discharge	280.00	cfs



100' ROW GREEN VALLEY 100-YR AT 1-FOOT OF DEPTH
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT 1-FOOT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.7500	%
Discharge	185.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	1.00	ft
Elevation Range	0.00 to 2.00	
Flow Area	42.0	ft²
Wetted Perimeter	98.68	ft
Top Width	96.77	ft
Actual Depth	1.00	ft
Critical Elevation	1.05	ft
Critical Slope	0.5237	%
Velocity	4.41	ft/s
Velocity Head	0.30	ft
Specific Energy	1.30	ft
Froude Number	1.18	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17

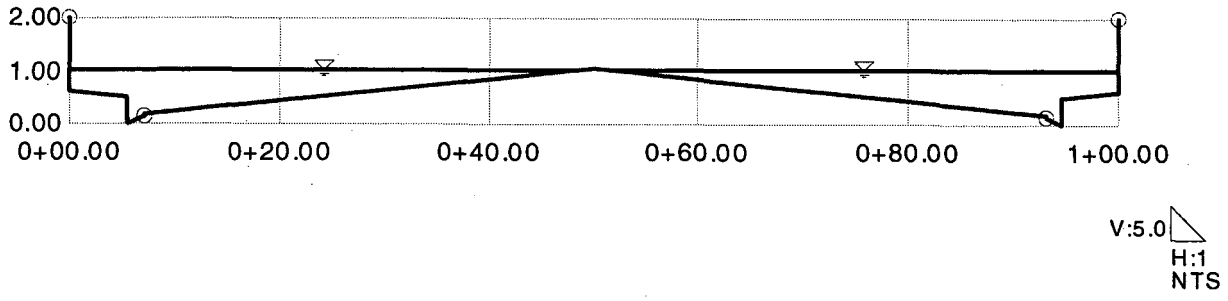
100' ROW GREEN VALLEY 100-YR AT 1-FOOT OF DEPTH
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW GREEN VALLEY 100-YR AT 1-FOOT OF DEPTH
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT 1-FOOT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	0.7500	%
Water Surface Elevation	1.00	ft
Elevation Range	0.00 to 2.00	
Discharge	185.00	cfs



100' ROW GREEN VALLEY 100-YR AT SECTION A-A
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.7500	%
Discharge	24.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.56	ft
Elevation Range	0.00 to 2.00	
Flow Area	9.4	ft²
Wetted Perimeter	50.32	ft
Top Width	49.22	ft
Actual Depth	0.56	ft
Critical Elevation	0.57	ft
Critical Slope	0.7137	%
Velocity	2.54	ft/s
Velocity Head	0.10	ft
Specific Energy	0.66	ft
Froude Number	1.02	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17

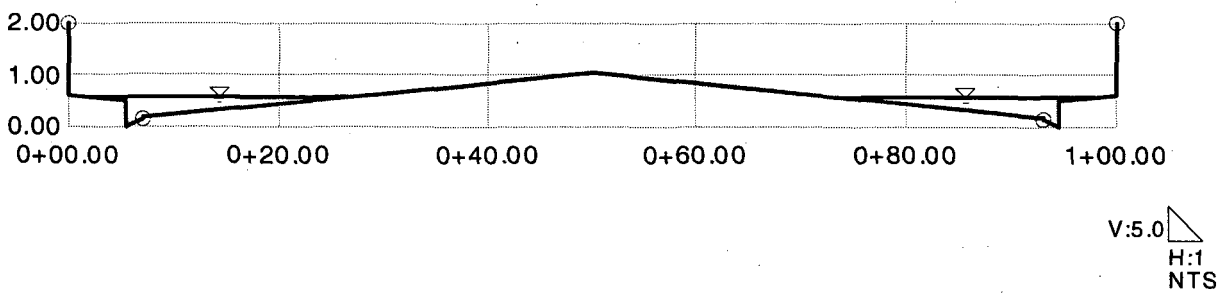
100' ROW GREEN VALLEY 100-YR AT SECTION A-A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW GREEN VALLEY 100-YR AT SECTION A-A
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	0.7500	%
Water Surface Elevation	0.56	ft
Elevation Range	0.00 to 2.00	
Discharge	24.00	cfs



100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	132.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.81	ft
Elevation Range	0.00 to 2.00	
Flow Area	25.6	ft²
Wetted Perimeter	79.52	ft
Top Width	77.99	ft
Actual Depth	0.81	ft
Critical Elevation	0.93	ft
Critical Slope	0.5492	%
Velocity	5.16	ft/s
Velocity Head	0.41	ft
Specific Energy	1.22	ft
Froude Number	1.59	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+43.00	0.89
0+43.00	1.39

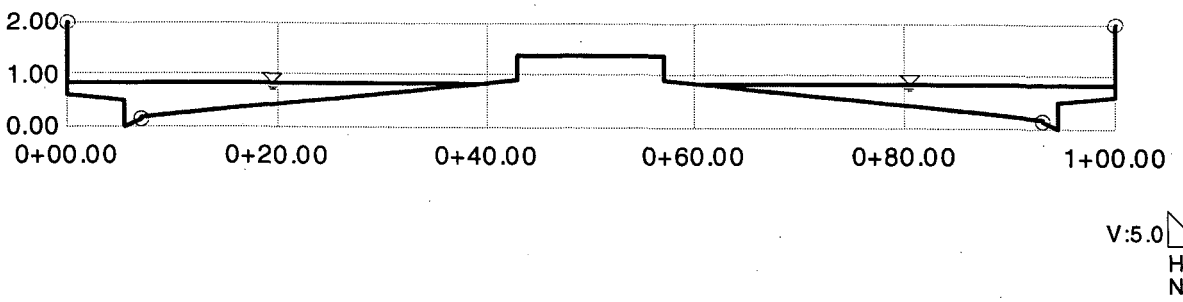
100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+57.00	1.39
0+57.00	0.89
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Water Surface Elevation	0.81	ft
Elevation Range	0.00 to 2.00	
Discharge	132.00	cfs



100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B'
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	87.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.72	ft
Elevation Range	0.00 to 2.00	
Flow Area	19.0	ft²
Wetted Perimeter	70.36	ft
Top Width	69.01	ft
Actual Depth	0.72	ft
Critical Elevation	0.82	ft
Critical Slope	0.5907	%
Velocity	4.59	ft/s
Velocity Head	0.33	ft
Specific Energy	1.05	ft
Froude Number	1.54	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+43.00	0.89
0+43.00	1.39

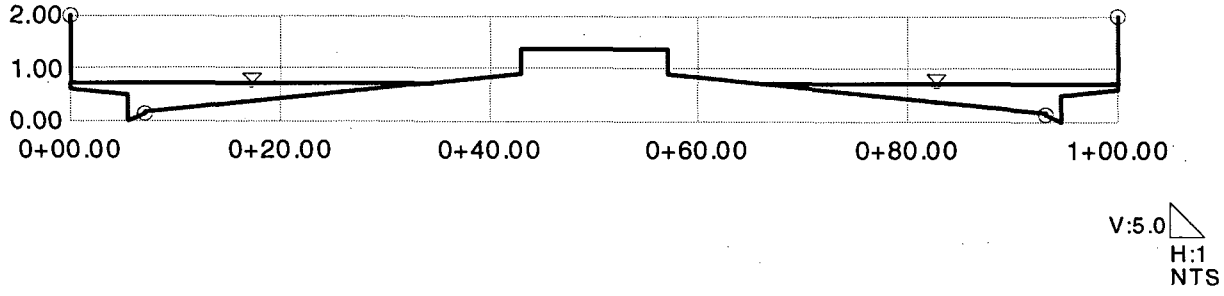
100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+57.00	1.39
0+57.00	0.89
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS 100-YEAR AT SECTION B-B'
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	*Channel Depth*

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Water Surface Elevation	0.72	ft
Elevation Range	0.00 to 2.00	
Discharge	87.00	cfs



100' ROW WARM SPRINGS 100-YEAR AT SECTION C-C
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS 100-YEAR AT SECTION C-C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.5000	%
Discharge	108.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.76	ft
Elevation Range	0.00 to 2.00	
Flow Area	22.1	ft²
Wetted Perimeter	74.90	ft
Top Width	73.46	ft
Actual Depth	0.76	ft
Critical Elevation	0.88	ft
Critical Slope	0.5719	%
Velocity	4.88	ft/s
Velocity Head	0.37	ft
Specific Energy	1.13	ft
Froude Number	1.57	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+43.00	0.89
0+43.00	1.39

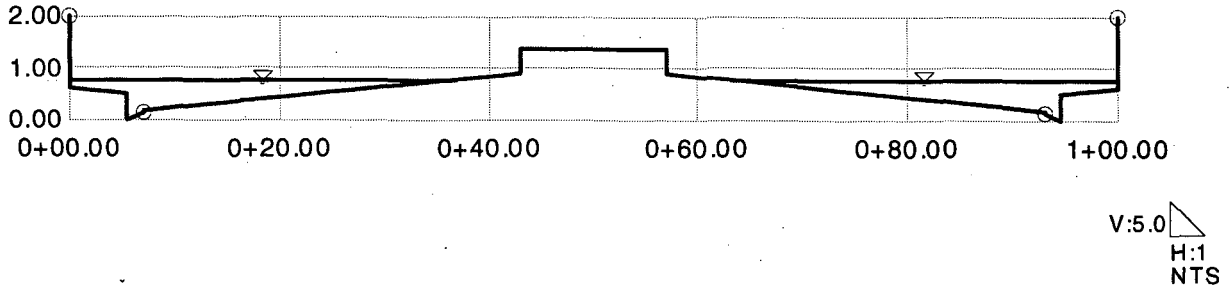
100' ROW WARM SPRINGS 100-YEAR AT SECTION C-C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+57.00	1.39
0+57.00	0.89
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW WARM SPRINGS 100-YEAR AT SECTION C-C
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW WARM SPRINGS 100-YEAR AT SECTION C-C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.5000	%
Water Surface Elevation	0.76	ft
Elevation Range	0.00 to 2.00	
Discharge	108.00	cfs



100' ROW GREEN VALLEY 100-YR AT SECTION D-D
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT SECTION D-D'
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.7500	%
Discharge	53.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.69	ft
Elevation Range	0.00 to 2.00	
Flow Area	17.1	ft²
Wetted Perimeter	67.47	ft
Top Width	66.18	ft
Actual Depth	0.69	ft
Critical Elevation	0.71	ft
Critical Slope	0.6365	%
Velocity	3.11	ft/s
Velocity Head	0.15	ft
Specific Energy	0.84	ft
Froude Number	1.08	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17

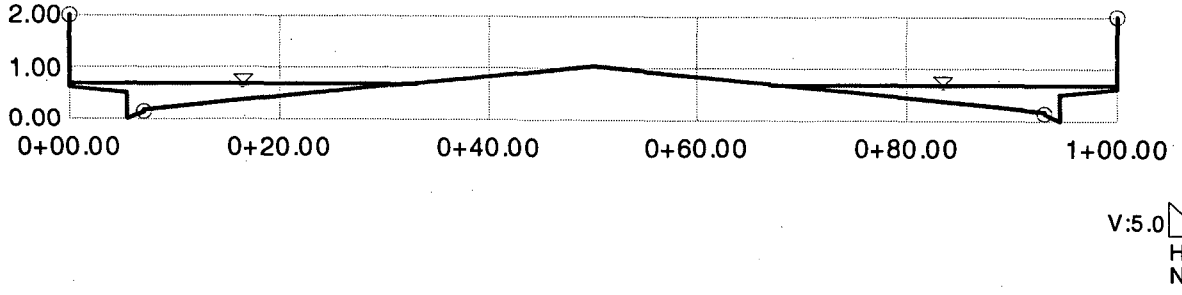
100' ROW GREEN VALLEY 100-YR AT SECTION D-D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW GREEN VALLEY 100-YR AT SECTION D-D
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT SECTION D-D'
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	0.7500	%
Water Surface Elevation	0.69	ft
Elevation Range	0.00 to 2.00	
Discharge	53.00	cfs



100' ROW GREEN VALLEY 100-YR AT SECTION D-D
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT SECTION D-D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.7500	%
Discharge	45.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.66	ft
Elevation Range	0.00 to 2.00	
Flow Area	15.2	ft²
Wetted Perimeter	64.51	ft
Top Width	63.28	ft
Actual Depth	0.66	ft
Critical Elevation	0.67	ft
Critical Slope	0.6517	%
Velocity	2.96	ft/s
Velocity Head	0.14	ft
Specific Energy	0.80	ft
Froude Number	1.07	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17

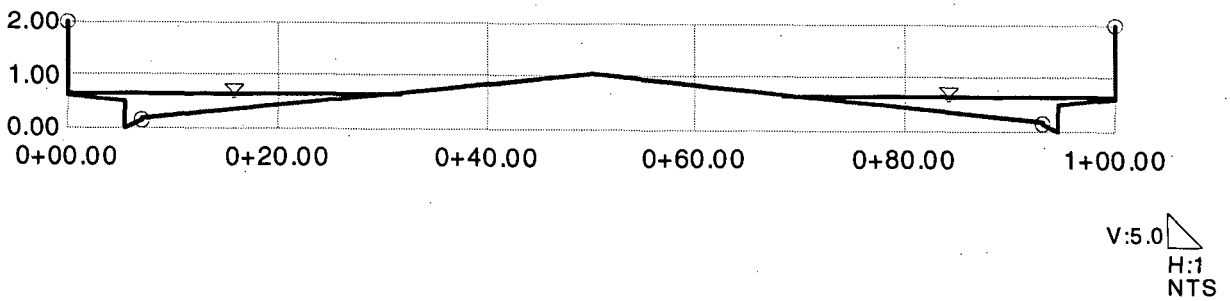
100' ROW GREEN VALLEY 100-YR AT SECTION D-D
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW GREEN VALLEY 100-YR AT SECTION D-D
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW GREEN VALLEY 100-YEAR AT SECTION D-D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	0.7500	%
Water Surface Elevation	0.66	ft
Elevation Range	0.00 to 2.00	
Discharge	45.00	cfs



GOLF COURSE FLOW DEPTH CALCULATION AT SECTION E-E
Worksheet for Irregular Channel

Project Description	
Worksheet	FLOW DEPTH CALCULATION FOR SECTION E-E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	2.5000	%
Discharge	149.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.025	
Water Surface Elevation	1,925.26	ft
Elevation Range	1,925.00 to 1,935.00	
Flow Area	39.5	ft²
Wetted Perimeter	154.96	ft
Top Width	154.92	ft
Actual Depth	0.26	ft
Critical Elevation	1,925.31	ft
Critical Slope	1.3535	%
Velocity	3.78	ft/s
Velocity Head	0.22	ft
Specific Energy	1,925.48	ft
Froude Number	1.32	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	4+25.00	0.025

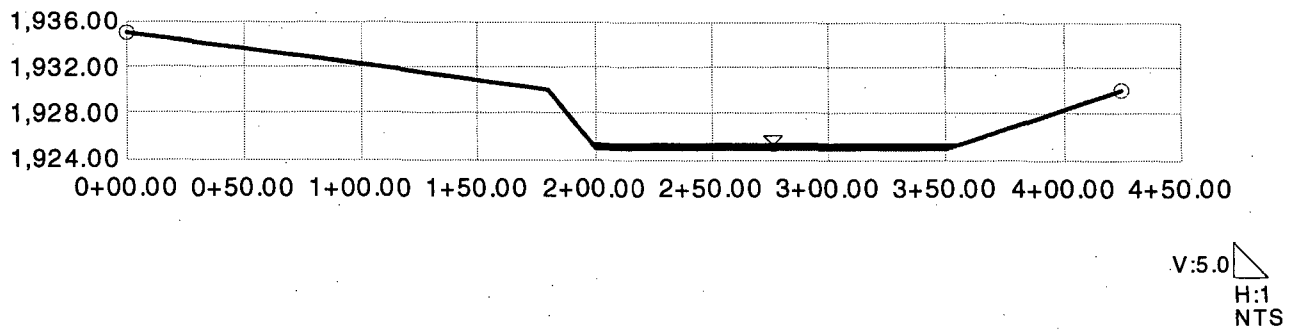
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1,935.00
1+80.00	1,930.00
2+00.00	1,925.00
3+50.00	1,925.00
4+25.00	1,930.00

GOLF COURSE FLOW DEPTH CALCULATION AT SECTION E-E
Cross Section for Irregular Channel

Project Description	
Worksheet	FLOW DEPTH CALCULATION FOR SECTION E-E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.025	
Slope	2.5000	%
Water Surface Elevation	1,925.26	ft
Elevation Range	1,925.00 to 1,935.00	
Discharge	149.00	cfs



AREA C

Flowmaster Cross-Sections

AREA C 48' ROW DEPTH CALCULATION SECTION A-A
Worksheet for Irregular Channel

Project Description	
Worksheet	AREA D 48' ROW SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	1.7000	%
Discharge	53.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	0.54	ft
Elevation Range	0.00 to 2.00	
Flow Area	11.5	ft²
Wetted Perimeter	46.44	ft
Top Width	45.74	ft
Actual Depth	0.54	ft
Critical Elevation	0.64	ft
Critical Slope	0.5882	%
Velocity	4.61	ft/s
Velocity Head	0.33	ft
Specific Energy	0.87	ft
Froude Number	1.62	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44

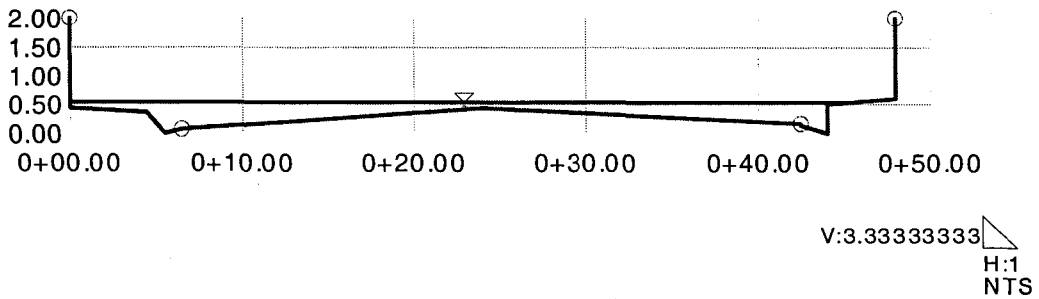
AREA C 48' ROW DEPTH CALCULATION SECTION A-A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50
0+48.00	0.60
0+48.00	2.00

AREA C 48' ROW DEPTH CALCULATION SECTION A-A
Cross Section for Irregular Channel

Project Description	
Worksheet	AREA D 48' ROW SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	1.7000	%
Water Surface Elevation	0.54	ft
Elevation Range	0.00 to 2.00	
Discharge	53.00	cfs



AREA D

Flowmaster Cross-Section

100' ROW SUNSET ROAD 100-YEAR AT SECTION A-A
Worksheet for Irregular Channel

Project Description	
Worksheet	100' ROW SUNSET ROAD 100-YEAR AT SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	6.1000 %
Discharge	231.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.017
Water Surface Elevation	0.78 ft
Elevation Range	0.00 to 2.00
Flow Area	23.1 ft²
Wetted Perimeter	76.22 ft
Top Width	74.75 ft
Actual Depth	0.78 ft
Critical Elevation	1.12 ft
Critical Slope	0.4910 %
Velocity	10.00 ft/s
Velocity Head	1.55 ft
Specific Energy	2.33 ft
Froude Number	3.17
Flow Type	Supercritical

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.015
0+07.00	0+93.00	0.017
0+93.00	1+00.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+43.00	0.89
0+43.00	1.39

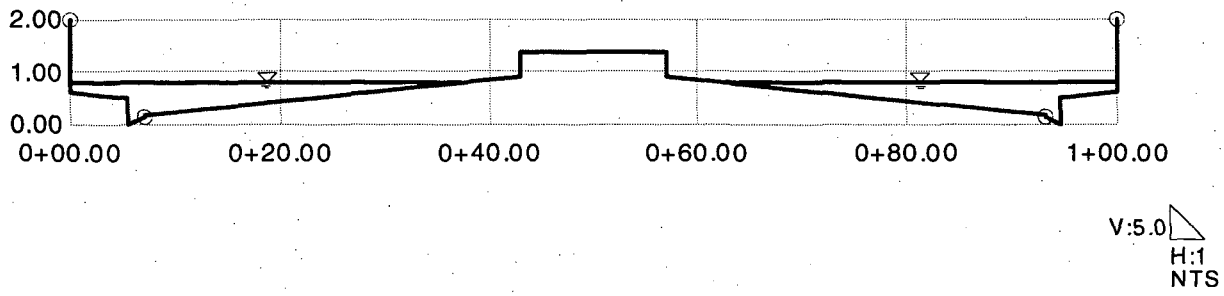
100' ROW SUNSET ROAD 100-YEAR AT SECTION A-A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+57.00	1.39
0+57.00	0.89
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
1+00.00	0.60
1+00.00	2.00

100' ROW SUNSET ROAD 100-YEAR AT SECTION A-A
Cross Section for Irregular Channel

Project Description	
Worksheet	100' ROW SUNSET ROAD 100-YEAR AT SECTION A-A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.017	
Slope	6.1000	%
Water Surface Elevation	0.78	ft
Elevation Range	0.00 to 2.00	
Discharge	231.00	cfs



AREA D 48' ROW DEPTH CALCULATION SECTION B-B AT C2
Worksheet for Irregular Channel

Project Description	
Worksheet	AREA E 48' ROW SECTION B-B AT C2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	1.8000 %
Discharge	221.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.016
Water Surface Elevation	0.87 ft
Elevation Range	0.00 to 2.00
Flow Area	27.1 ft²
Wetted Perimeter	49.30 ft
Top Width	48.00 ft
Actual Depth	0.87 ft
Critical Elevation	1.18 ft
Critical Slope	0.4342 %
Velocity	8.15 ft/s
Velocity Head	1.03 ft
Specific Energy	1.90 ft
Froude Number	1.91
Flow Type	Supercritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+06.50	0.015
0+06.50	0+42.50	0.017
0+42.50	0+48.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.46
0+04.00	0.38
0+04.38	0.38
0+05.50	0.00
0+06.50	0.09
0+24.00	0.44
0+42.50	0.17
0+42.50	0.13
0+44.00	0.00
0+44.00	0.50

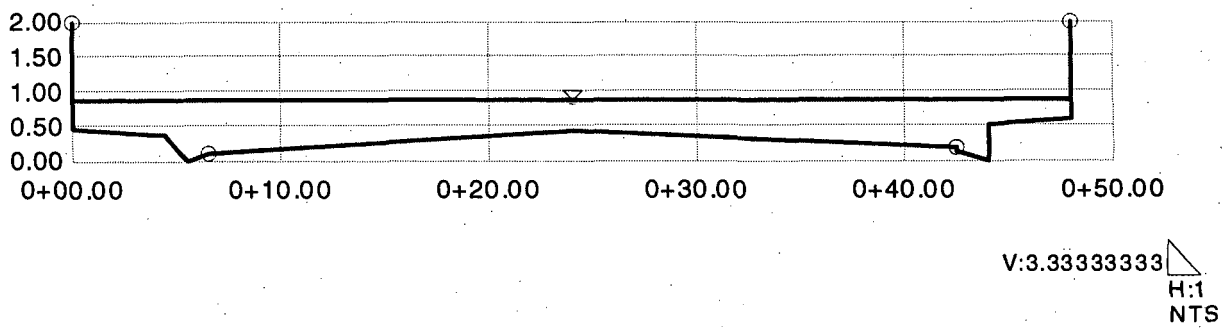
AREA D 48' ROW DEPTH CALCULATION SECTION B-B AT C2
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+48.00	0.60
0+48.00	2.00

AREA D 48' ROW DEPTH CALCULATION SECTION B-B AT C2
Cross Section for Irregular Channel

Project Description	
Worksheet	AREA E 48' ROW SECTION B-B AT C2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Slope	1.8000 %
Water Surface Elevation	0.87 ft
Elevation Range	0.00 to 2.00
Discharge	221.00 cfs



AREAD D SECTION D-D (APARTMENT COMPLEX)
Worksheet for Rectangular Channel

Project Description	
Worksheet	AREA D APT SECTION D-D
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

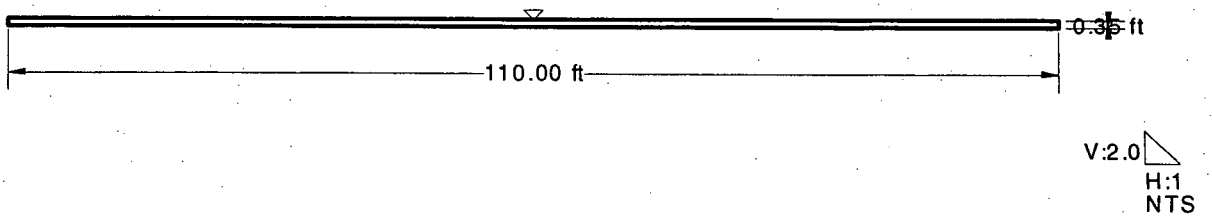
Input Data		
Mannings Coefficient	0.025	
Slope	4.0000	%
Bottom Width	110.00	ft
Discharge	231.00	cfs

Results		
Depth	0.35	ft
Flow Area	39.0	ft²
Wetted Perimeter	110.71	ft
Top Width	110.00	ft
Critical Depth	0.52	ft
Critical Slope	1.1500	%
Velocity	5.93	ft/s
Velocity Head	0.55	ft
Specific Energy	0.90	ft
Froude Number	1.76	
Flow Type	Supercritical	

AREA D SECTION D-D (APARTMENT COMPLEX)
Cross Section for Rectangular Channel

Project Description	
Worksheet	AREA D APT SECTION D-D
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.025	
Slope	4.0000	%
Depth	0.35	ft
Bottom Width	110.00	ft
Discharge	231.00	cfs



AREAD D SECTION E-E (APARTMENT COMPLEX)
Worksheet for Rectangular Channel

Project Description	
Worksheet	AREA D APT SECTION E-E
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

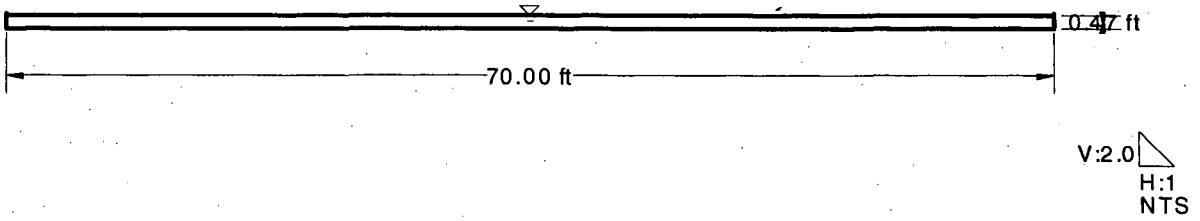
Input Data		
Mannings Coefficient	0.025	
Slope	4.0000	%
Bottom Width	70.00	ft
Discharge	231.00	cfs

Results		
Depth	0.47	ft
Flow Area	32.6	ft^2
Wetted Perimeter	70.93	ft
Top Width	70.00	ft
Critical Depth	0.70	ft
Critical Slope	1.0546	%
Velocity	7.08	ft/s
Velocity Head	0.78	ft
Specific Energy	1.25	ft
Froude Number	1.83	
Flow Type	Supercritical	

AREA D SECTION E-E (APARTMENT COMPLEX)
Cross Section for Rectangular Channel

Project Description	
Worksheet	AREA D APT SECTION E-E
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.025
Slope	4.0000 %
Depth	0.47 ft
Bottom Width	70.00 ft
Discharge	231.00 cfs



AREAD D SECTION F-F (APARTMENT COMPLEX)
Worksheet for Rectangular Channel

Project Description	
Worksheet	AREA D APT SECTION F-F
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

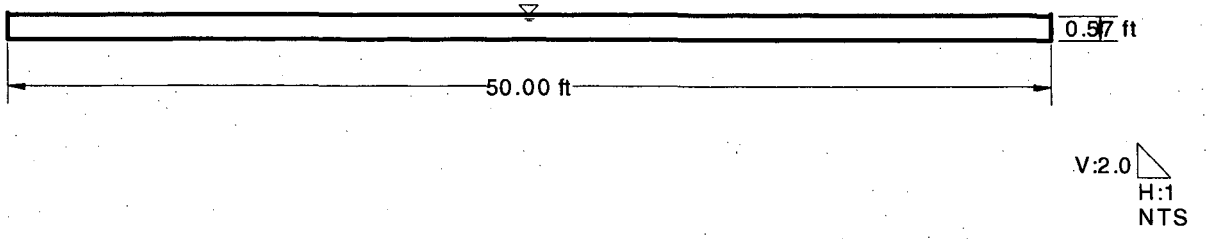
Input Data		
Mannings Coefficient	0.025	
Slope	4.0000	%
Bottom Width	50.00	ft
Discharge	231.00	cfs

Results		
Depth	0.57	ft
Flow Area	28.6	ft^2
Wetted Perimeter	51.14	ft
Top Width	50.00	ft
Critical Depth	0.87	ft
Critical Slope	0.9978	%
Velocity	8.07	ft/s
Velocity Head	1.01	ft
Specific Energy	1.58	ft
Froude Number	1.88	
Flow Type	Supercritical	

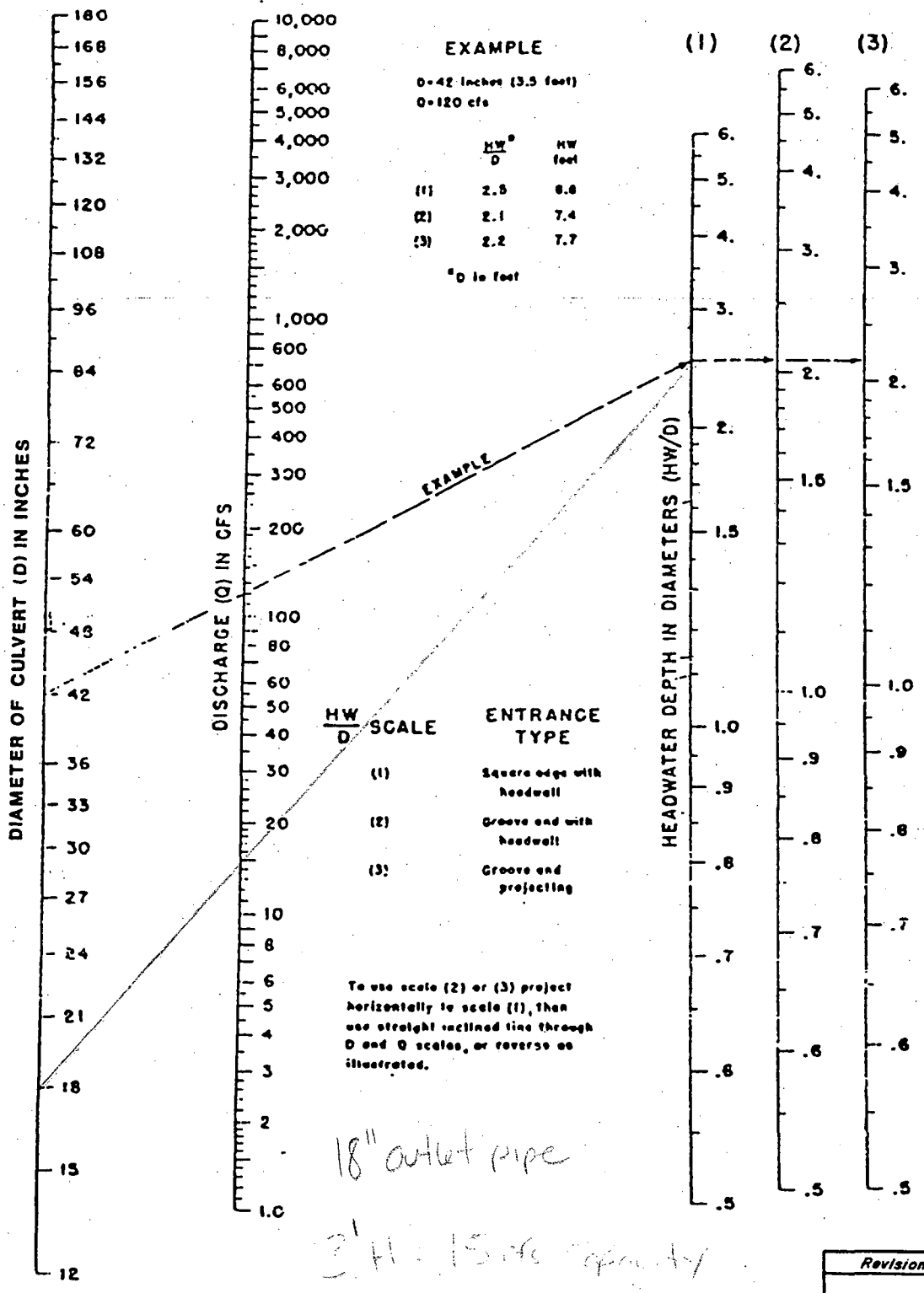
AREA D SECTION F-F (APARTMENT COMPLEX)
Cross Section for Rectangular Channel

Project Description	
Worksheet	AREA D APT SECTION F-F
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.025	
Slope	4.0000	%
Depth	0.57	ft
Bottom Width	50.00	ft
Discharge	231.00	cfs



NOMOGRAPH – INLET CONTROL RCP



Revision	Date

WRC ENGINEERING

REFERENCE:
USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

APPENDIX E

Reference Material

PBS&J

An employee-owned company

April 2, 2004

Mr. Max H. Yuan, P.E.
Federal Emergency Management Agency
Mitigation Hazard Identification Branch
500 C Street, SW
Washington, DC 20472

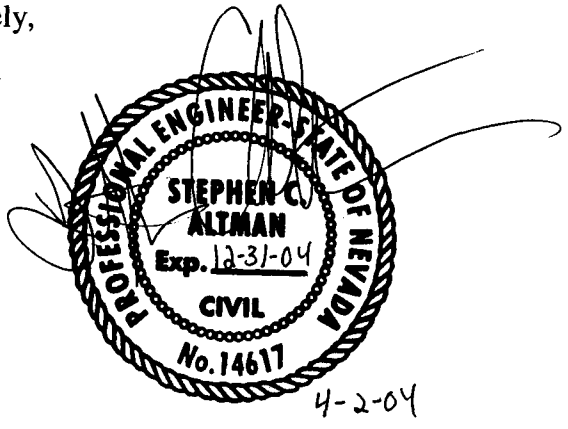
RE: AS-BUILT CERTIFICATION FOR LETTER OF MAP REVISION APPLICATION FOR GREEN VALLEY AREA, CLARK COUNTY, NV
PBS&J REFERNCE NO.: 511542.00

Dear Mr. Yuan,

I, Stephen Altman, hereby certify that the Crossings Apartment development was built in substantial conformance with the grading plans, included in this LOMR, by VTN sheets 1 through 12.

Sincerely,

PBS&J



Stephen C. Altman, P.E., CFM
Lic. 14617, Nevada

2270 Corporate Circle, Suite 100, Henderson, Nevada 89074-6382 • Telephone 702.263.7275 • Fax 702.263.7200 • www.pbsj.com

AREA B

Civil Improvement Plans

GRADING AND IMPROVEMENT PLANS

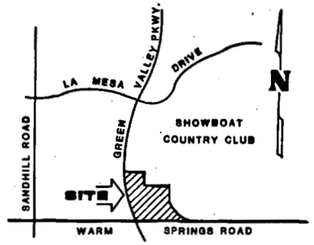
FOR

THE CROSSING AT GREEN VALLEY

CITY OF HENDERSON
STATE OF NEVADA

ESTIMATE OF QUANTITIES (OFF-SITE)

2" A. C. PAVING	———
3" A. C. PAVING	8,288 SY
CURB & GUTTER (24" L - TYPE)	1,989 LF
CURB & GUTTER (18" ISLAND CURB)	1,881 LF
CONCRETE VALLEY GUTTER	———
4" CONCRETE SIDEWALK	11,866 SF
STREET LIGHTS	17 EA
ISLAND CONCRETE	1,386 SF



VICINITY MAP

GENERAL NOTES

1. POWER POLES AND/OR OTHER EXISTING FACILITIES NOT IN PROPER LOCATION BASED ON PROPOSED IMPROVEMENTS SHOWN HEREON WILL BE RELOCATED OR PLACED UNDERGROUND PER CITY OF HENDERSON ORDINANCE AT NO EXPENSE TO THE CITY OF HENDERSON.
2. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITION BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO SAID CONSTRUCTION. EXTENT OF TRANSITIONS TO BE DETERMINED BY THE CITY OF HENDERSON.
3. EXISTING UTILITIES ARE LOCATED ON PLANS FOR THE CONVENIENCE OF THE CONTRACTOR ONLY. THE CONTRACTOR SHALL BEAR FULL RESPONSIBILITY FOR THE PROTECTION OF UTILITIES AND THE ENGINEER BEARS NO RESPONSIBILITY FOR UTILITIES NOT SHOWN ON THE PLANS OR NOT IN THE LOCATION SHOWN ON THE PLANS.
4. CONSTRUCTION TO BE PER UNIFORM STANDARD SPECIFICATIONS AND DRAWINGS, CITY OF HENDERSON, NEVADA. (LATEST EDITION)
5. APPROVAL OF THESE PLANS IS FOR THE CONSTRUCTION OF OFFSITE IMPROVEMENTS ONLY. ALL ONSITE IMPROVEMENTS, INCLUDING BLOCK WALLS, MUST BE APPROVED BY THE BUILDING AND PLANNING DIVISIONS OF THE CITY OF HENDERSON.
6. ALL GRADING SHALL CONFORM TO THE SOILS REPORT.
   ENGINEER J. H. KLEINFELDER
   DATE SEPT. 26, 1985
   JOB NUMBER L-1486-1

SHEET INDEX

ENGINEERS CERTIFICATE

MYRON R. WELSH — DATE
NEVADA CERTIFICATE NO. 2046

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy. Elev. 1969.01

APPROVALS

MARK T. CALHOUN, P.E. — DATE
CITY ENGINEER

CENTEL — DATE

DALE STARR — DATE
FIRE DEPARTMENT

NEVADA POWER CO. — DATE

C.P. NATIONAL / SOUTHWEST GAS — 4/9/86 DATE

CITY BUILDING SUPERINTENDENT — 5-1-86 DATE

ALL STREET STRUCTURAL SECTIONS SHALL BE PER THE RECOMMENDATIONS OF THE SOILS ENGINEER, BASED ON CBR OR R-VALUES. NO PAVING OR BASE WORK SHALL COMMENCE UNTIL A STREET STRUCTURAL SECTION IS APPROVED BY THE CITY ENGINEER, CITY OF HENDERSON.

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY MAY 1, 1987.

BASIS OF BEARINGS

N 00° 36' 51" E, THE WEST LINE OF THE SW 1/4 OF SECTION 5, TOWNSHIP 22 SOUTH, RANGE 62 EAST, M.D.B.&M., AS SHOWN ON PARCEL MAP FILE 36, PAGE 88, CLARK COUNTY RECORDS, NEVADA.

REV | DATE | BY | REVISION

AMERICAN RESIDENTIAL PROPERTIES

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

TITLE: COVER SHEET

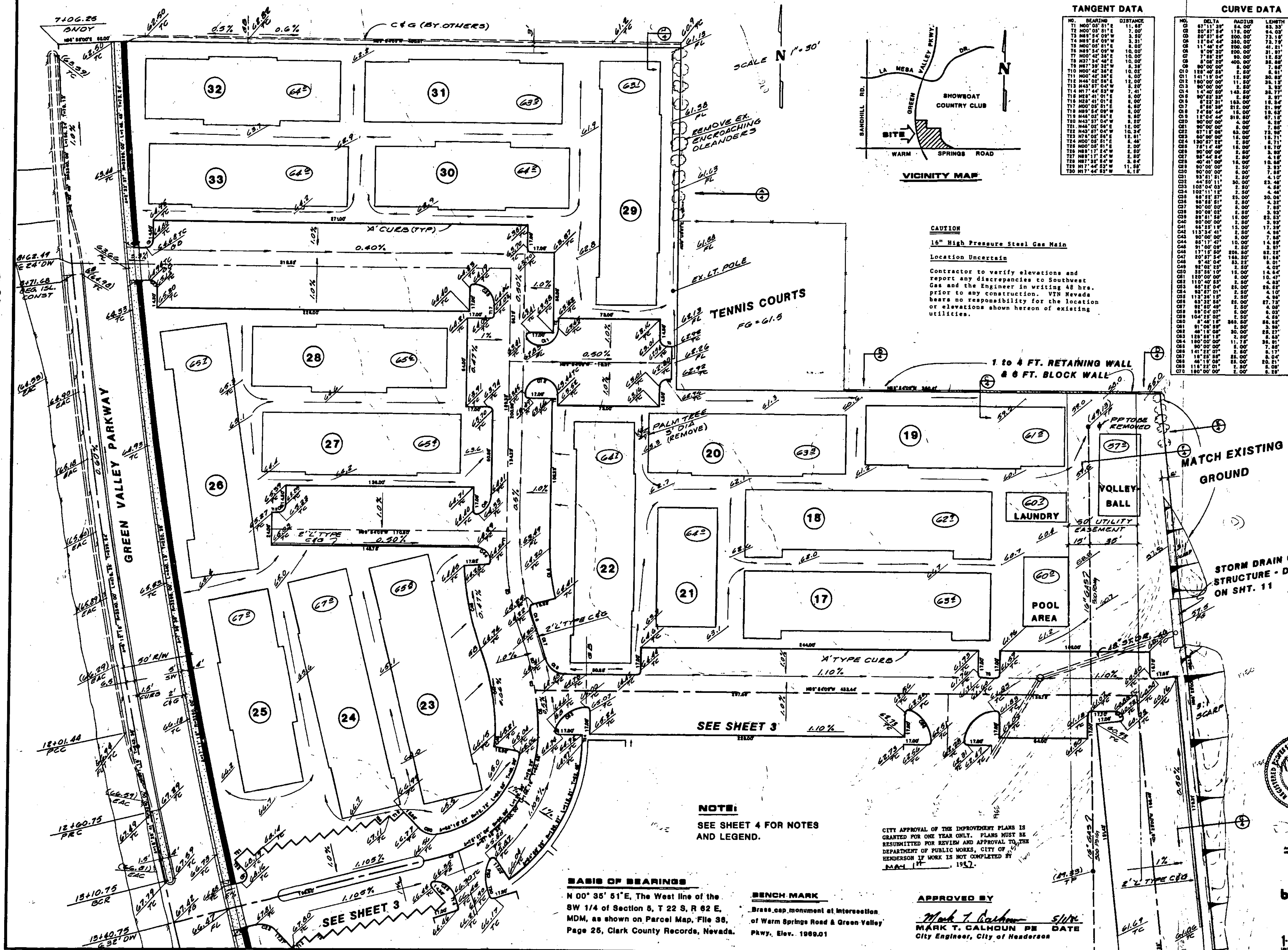
PROJECT: THE CROSSING AT GREEN VALLEY

WO NO 3354
BY tony f
DATE
SCALE none

SHEET 1 OF 12 SHEETS

B2
73

Ø2827



TANGENT DATA

NO.	BEARING	DISTANCE
T1	N00°05'51"E	11.65'
T2	N00°05'51"E	7.00'
T3	N89°54'09"W	3.50'
T4	N89°54'09"W	3.31'
T5	N00°05'51"E	8.00'
T6	N89°54'09"W	10.00'
T7	N00°42'36"E	10.00'
T8	N37°34'48"E	10.00'
T9	N67°39'32"W	5.38'
T10	N00°42'36"E	10.02'
T11	N00°42'36"E	6.00'
T12	N46°02'56"E	12.00'
T13	N43°57'04"W	5.20'
T14	N17°44'53"W	7.41'
T15	N28°41'01"E	8.00'
T16	N28°41'01"E	8.00'
T17	N00°05'51"E	6.50'
T18	N89°54'09"W	5.00'
T19	N46°02'56"E	9.80'
T20	N43°57'04"W	8.20'
T21	N46°02'56"E	12.00'
T22	N43°57'04"W	10.34'
T23	N76°02'56"E	12.81'
T24	N00°05'51"E	6.46'
T25	N00°05'51"E	2.00'
T26	N89°17'24"W	2.50'
T27	N89°17'24"W	2.50'
T28	N87°32'54"W	3.64'
T29	N17°44'53"W	11.58'
T30	N17°44'53"W	6.18'

CURVE DATA

NO.	DELTA	RADIUS	LENGTH	TAN
C1	67°11'39"	54.00'	63.33'	35.87'
C2	20°57'54"	175.00'	64.03'	32.38'
C3	20°57'54"	200.00'	73.18'	37.00'
C4	12°04'44"	350.00'	73.79'	37.03'
C5	11°48'24"	200.00'	41.21'	20.68'
C6	9°09'30"	200.00'	31.97'	16.02'
C7	7°58'29"	90.00'	12.53'	6.27'
C8	5°08'20"	400.00'	35.88'	17.95'
C9	90°00'00"	5.00'	7.85'	5.00'
C10	128°40'56"	2.50'	5.61'	5.20'
C11	141°19'04"	12.50'	30.83'	35.61'
C12	180°00'00"	11.50'	36.13'	
C13	90°00'00"	2.50'	3.93'	2.50'
C14	14°40'50"	143.50'	36.77'	18.49'
C15	90°53'33"	2.50'	3.97'	2.54'
C16	5°23'31"	163.00'	15.34'	7.68'
C17	5°56'39"	212.00'	21.99'	11.01'
C18	74°59'44"	15.00'	19.63'	11.51'
C19	12°04'44"	318.50'	67.15'	33.70'
C20	90°00'00"	4.00'	6.28'	4.00'
C21	90°00'00"	5.00'	7.85'	5.00'
C22	67°15'06"	63.00'	73.95'	41.90'
C23	60°00'00"	15.00'	15.71'	8.66'
C24	130°57'22"	2.50'	5.71'	5.48'
C25	75°14'49"	15.00'	19.70'	11.56'
C26	90°00'00"	2.50'	3.93'	2.50'
C27	95°44'54"	2.50'	4.18'	2.76'
C28	40°41'00"	15.00'	10.65'	5.56'
C29	90°00'00"	2.50'	3.93'	2.50'
C30	90°00'00"	5.00'	7.85'	5.00'
C31	93°51'51"	2.50'	4.10'	2.67'
C32	44°50'11"	30.00'	23.48'	12.38'
C33	105°04'03"	2.50'	4.58'	3.28'
C34	102°11'12"	2.50'	4.46'	3.10'
C35	68°52'57"	25.00'	30.06'	17.14'
C36	98°55'51"	2.50'	4.32'	2.92'
C37	90°00'00"	5.00'	7.85'	5.00'
C38	90°08'02"	2.50'	3.93'	2.51'
C39	89°51'58"	15.00'	23.53'	14.97'
C40	90°00'00"	2.50'	3.93'	2.50'
C41	66°25'19"	15.00'	17.39'	9.82'
C42	113°34'41"	2.50'	4.96'	3.82'
C43	90°00'00"	5.00'	7.85'	5.00'
C44	85°17'47"	10.00'	14.89'	9.21'
C45	91°00'09"	2.50'	3.97'	2.54'
C46	17°15'50"	206.50'	62.22'	31.35'
C47	20°57'54"	168.50'	61.66'	31.18'
C48	9°42'04"	53.22'	9.01'	4.52'
C49	92°02'25"	2.50'	4.02'	2.59'
C50	55°56'10"	15.00'	14.64'	7.96'
C51	120°00'00"	5.00'	10.47'	8.66'
C52	110°40'55"	2.50'	4.83'	3.62'
C53	65°22'04"	25.00'	28.52'	16.04'
C54	93°57'01"	2.50'	4.10'	2.68'
C55	113°36'15"	2.50'	4.96'	3.82'
C56	63°32'58"	25.00'	27.73'	15.49'
C57	92°50'49"	2.50'	4.05'	2.63'
C58	69°04'07"	5.00'	6.03'	3.44'
C59	104°25'02"	2.50'	4.56'	3.22'
C60	8°48'15"	368.50'	56.62'	28.37'
C61	91°08'59"	2.50'	3.98'	2.55'
C62	48°16'08"	30.00'	25.27'	13.44'
C63	128°58'15"	2.50'	5.63'	5.23'
C64	180°00'00"	11.75'	36.91'	
C65	90°00'00"	5.00'	7.85'	5.00'
C66	141°22'07"	2.50'	6.17'	7.13'
C67	18°25'55"	25.00'	8.04'	4.06'
C68	46°18'08"	25.00'	20.21'	10.69'
C69	116°22'01"	2.50'	5.08'	4.03'
C70	180°00'00"	2.00'	6.28'	

CAUTION

16" High Pressure Steel Gas Main

Location Uncertain

Contractor to verify elevations and report any discrepancies to Southwest Gas and the Engineer in writing 48 hrs. prior to any construction. VTN Nevada bears no responsibility for the location or elevations shown hereon of existing utilities.

NOTE:

SEE SHEET 4 FOR NOTES AND LEGEND.

BASIS OF BEARINGS

N 00° 35' 51"E, The West line of the SW 1/4 of Section 5, T 22 S, R 62 E, MDM, as shown on Parcel Map, File 36, Page 25, Clark County Records, Nevada.

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy. Elev. 1969.01

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY MAY 1st, 1987.

APPROVED BY

Mark T. Calhoun 5/1/86

MARK T. CALHOUN PE DATE

City Engineer, City of Henderson

Call before you Dig.

1-800-227-2600

REV	DATE	BY	REVISION
1	10/9/86	DA	RETAINING WALL DETAILS
2	11/26/86	DA	RETAINING WALL DETAIL "H"

AMERICAN RESIDENTIAL PROPERTIES

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

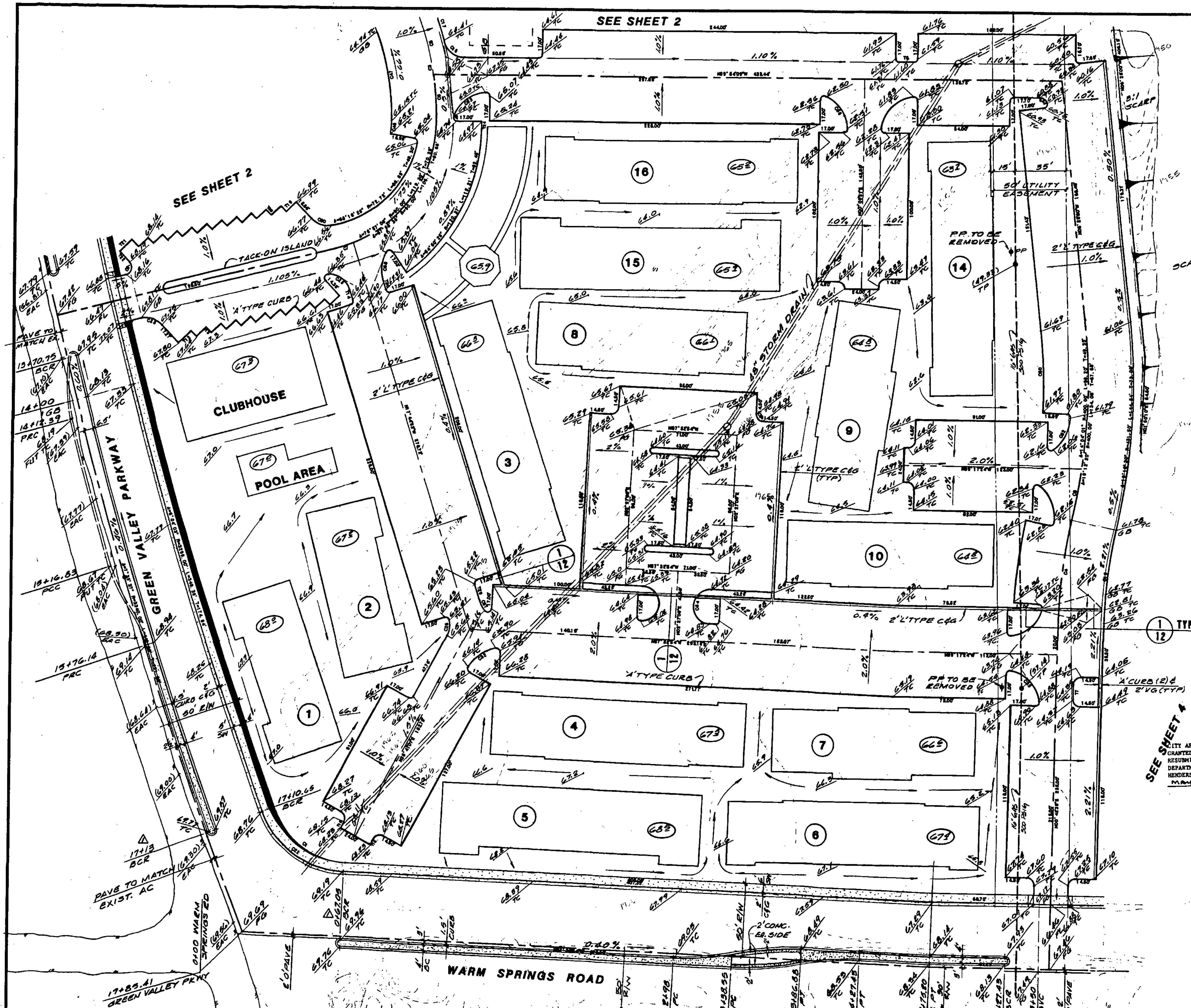
VTN nevada

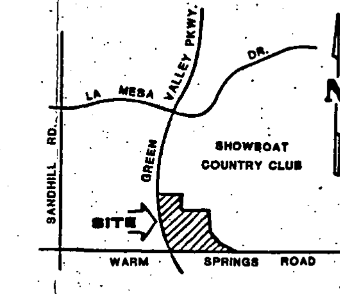
TITLE: GRADING PLAN

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO.	3354
BY	SCD / EMP
DATE	
SCALE	1" : 30'
SHEET	2
OF	12 SHEETS

02827





VICINITY MAP

NOTE:

SEE SHEET 4 FOR NOTES AND LEGEND.

CAUTION

16" High Pressure Steel Gas Main

Location Uncertain

Contractor to verify elevations and report any discrepancies to Southwest Gas and the Engineer in writing 48 hrs. prior to any construction. VTN Nevada bears no responsibility for the location or elevations shown hereon of existing utilities.

(1/12) TYP

Avoid cutting underground utility lines. It's costly.

Call before you Dig.

1-800-227-2600

UNDERGROUND SERVICE (USA)

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY MAY 11th, 1987

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy. Elev. 1969.01

BASIS OF BEARINGS

N 00° 35' 51" E, The West line of the SW 1/4 of Section 5, T 22 S, R 62 E, MDM, as shown on Parcel Map, File 36, Page 25, Clark County Records, Nevada.

APPROVED BY

Mark T. Calhoun 5/1/86

MARK T. CALHOUN PE DATE

City Engineer, City of Henderson

REV	DATE	BY	REVISION
1	7/14/86	EMP	ISL. NOSES WERE 16+78.41 & 0+98 7/14/86

AMERICAN RESIDENTIAL PROPERTIES

VTN nevada

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

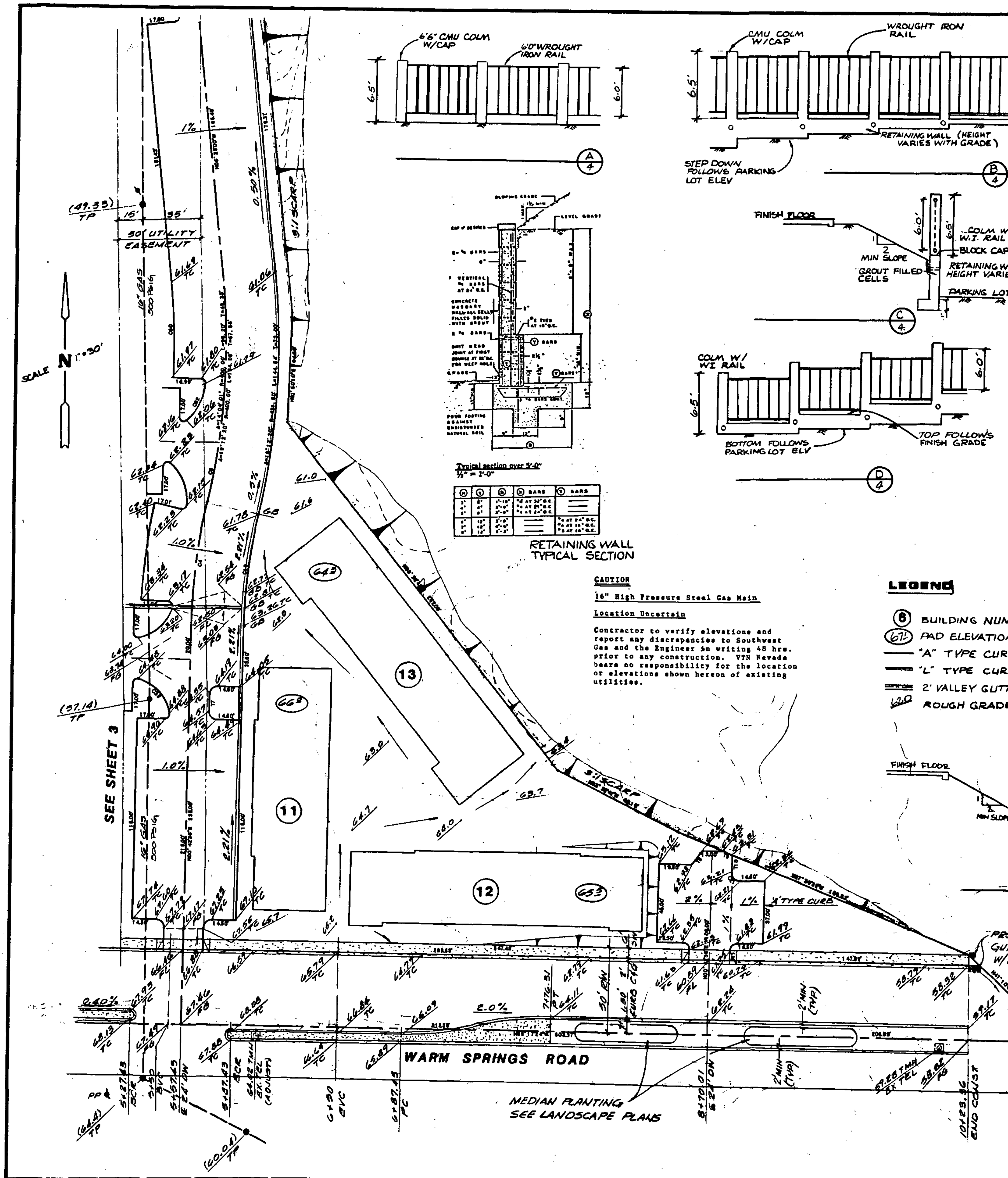
TITLE: GRADING PLAN

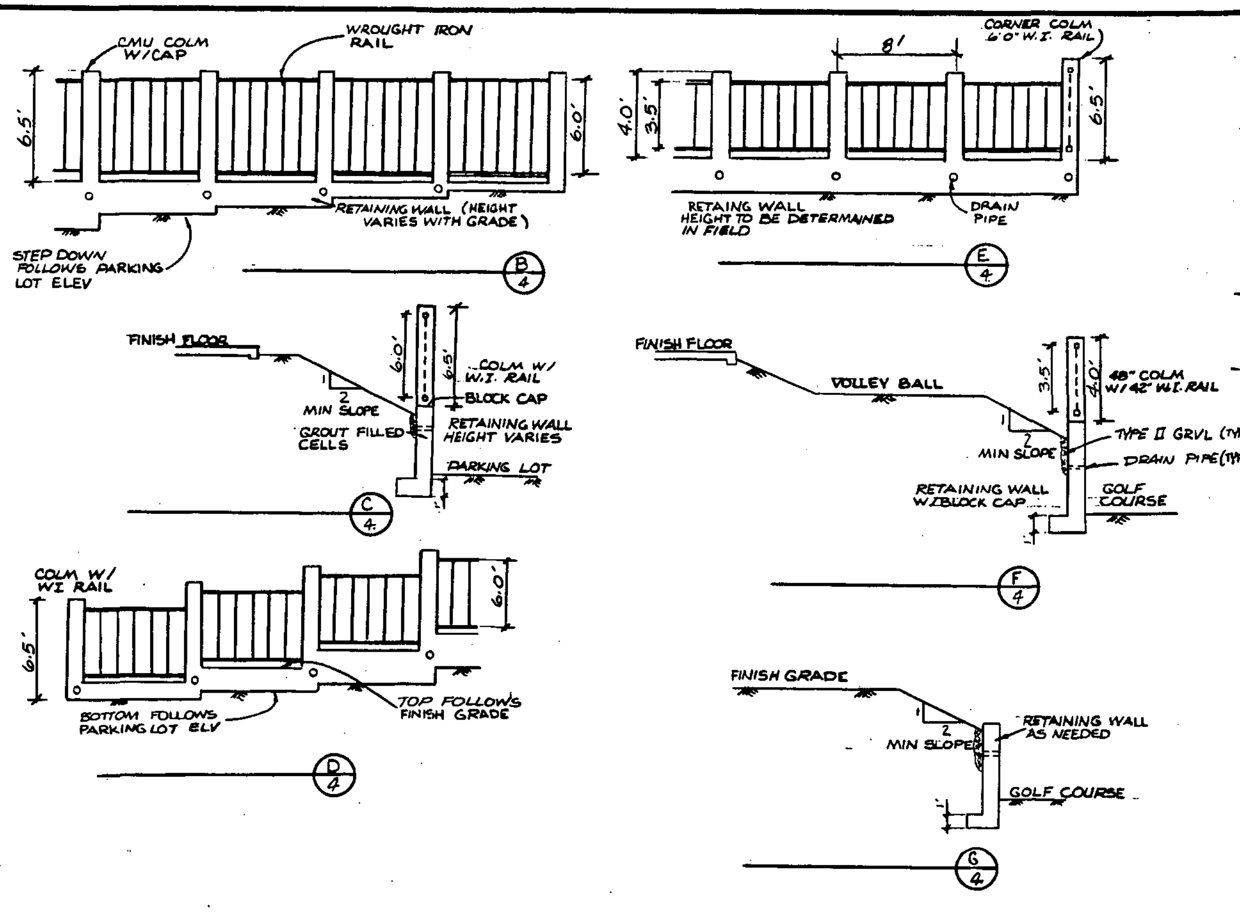
PROJECT: THE CROSSING AT GREEN VALLEY

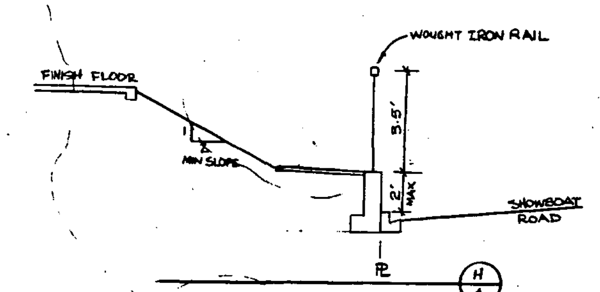
WO NO.	3354
BY	SCD / EMP
DATE	
SCALE	1" : 30'

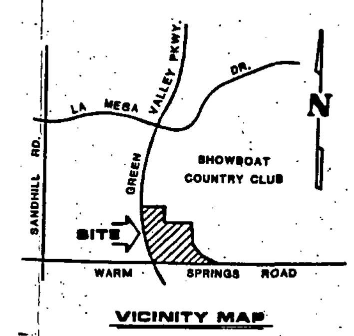
SHEET 3 OF 12 SHEETS

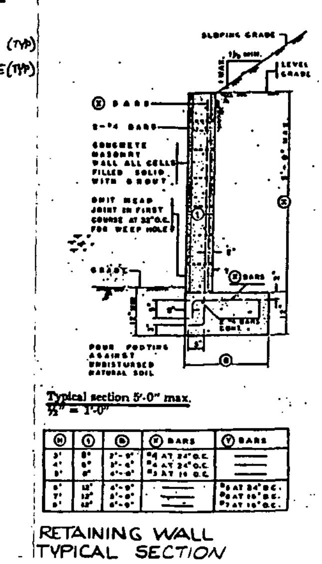
Φ2827











CAUTION

16" High Pressure Steel Gas Main

Location Uncertain

Contractor to verify elevations and report any discrepancies to Southwest Gas and the Engineer in writing 48 hrs. prior to any construction. VTN Nevada bears no responsibility for the location or elevations shown hereon of existing utilities.

LEGEND

- (6) BUILDING NUMBER
- (67.1) PAD ELEVATION (ROUGH GRADE) (FF 12" ABOVE PAD ELE)
- "A" TYPE CURB
- "L" TYPE CURB
- 2' VALLEY GUTTER (DET 1, SHT 12)
- 62.0 ROUGH GRADE (SEE NOTE 1)

GENERAL NOTES

1. ALL GRADES SHOWN HEREON ARE TO ROUGH GRADE ONLY AND ARE 0.3 FEET LOW TO ALLOW FOR LANDSCAPING EXCEPT TC, FL, INV, AND FG WHICH ARE TO FINISH GRADE. FF TO BE 12" ABOVE ROUGH GRADE
2. ALL GRADING TO BE F.H.A. TYPE "A" DRAINAGE.
3. SEE PARCEL MAP FOR EXACT BEARINGS AND DISTANCES.
4. CONTRACTOR SHALL VERIFY ALL CONDITIONS AND DIMENSIONS AND SHALL REPORT ALL DISCREPANCIES TO THE ENGINEER IN WRITING PRIOR TO THE COMMENCEMENT OF WORK.
5. THE QUANTITIES SHOWN HEREWITH ARE ESTIMATES ONLY AND ARE NOT TO BE USED FOR BIDDING PURPOSES.
6. ALL GRADING SHALL CONFORM TO THE SOILS REPORT.

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY MAY 11, 19 87.

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy., Elev. 1969.01

BASIS OF BEARINGS

N 00° 35' 51" E, The West line of the SW 1/4 of Section 5, T 22 S, R 62 E, MDM, as shown on Parcel Map, File 36, Page 25, Clark County Records, Nevada.

APPROVED BY

Mark T. Calhoun 5/11/86
MARK T. CALHOUN PE DATE
City Engineer, City of Henderson

REV	DATE	BY	REVISION
1	10/23/86	DA	RETAINING WALL DETAILS
2	11/6/18	DA	RETAINING WALL DETAIL "H"

AMERICAN RESIDENTIAL PROPERTIES

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

VTN nevada

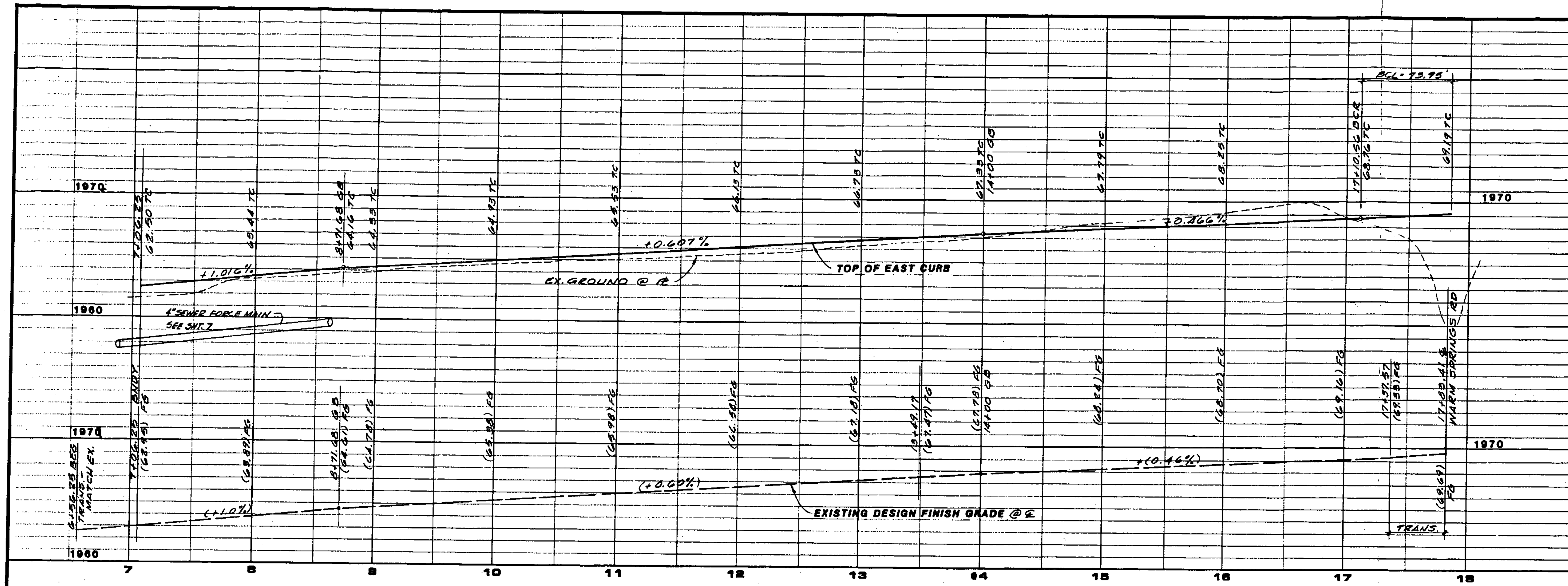
TITLE: GRADING PLAN

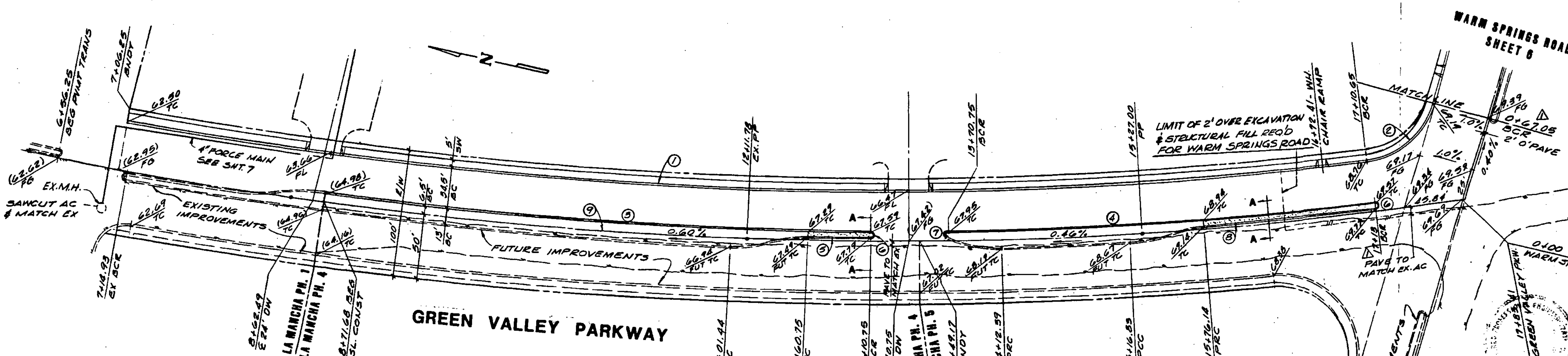
PROJECT: THE CROSSING AT GREEN VALLEY

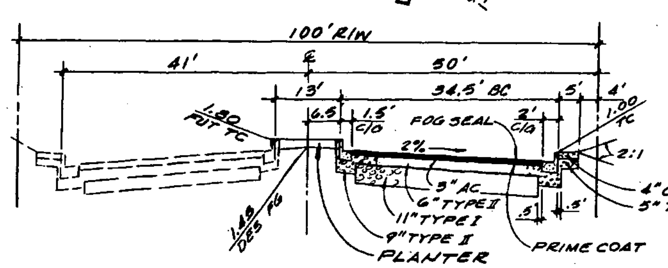
WO NO. 3354
BY SCD / EMP
DATE
SCALE 1" : 30'

SHEET 4 OF 12 SHEETS

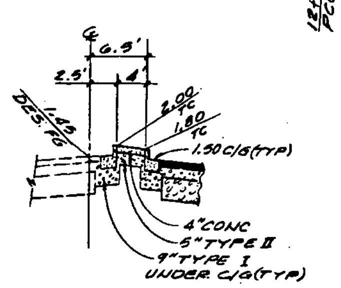
02827







TYPICAL STREET SECTION



SECTION A-A

BC CURVE DATA				
NO.	Δ	R	L	T
1	17°13'48"	3299.00'	992.07'	499.81'
2	67°15'06"	63.00'	73.95'	41.90'
3	7°31'55"	3333.50'	438.22'	219.42'
4	5°06'22'	3333.50'	297.08'	148.64
5	0°51'28'	3337.50	49.96'	24.98
6	180°00'00"	2.00'	6.28	–
7	155°36'27"	2.00	5.43'	9.25'
8	1°34'35"	3337.50'	92.20'	46.10'
9	18°28'41"	3340.00'	1077.16'	543.30'

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy. Elev. 1969.01

ALL STREET STRUCTURAL SECTIONS SHALL BE PER THE RECOMMENDATIONS OF THE SOILS ENGINEER, BASED ON CBR OR R-VALUES. NO PAVING OR BASE WORK SHALL COMMENCE UNTIL A STREET STRUCTURAL SECTION IS APPROVED BY THE CITY ENGINEER, CITY OF HENDERSON.

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY MAY 1, 1987.

APPROVED BY

MARK T. CALHOUN PE 5/1/86 DATE
City Engineer, City of Henderson

REV	DATE	BY	REVISION
1	7/14/86	EMP	ISL. NOSE WAS 16+73.41

AMERICAN RESIDENTIAL PROPERTIES

vtn nevada
CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

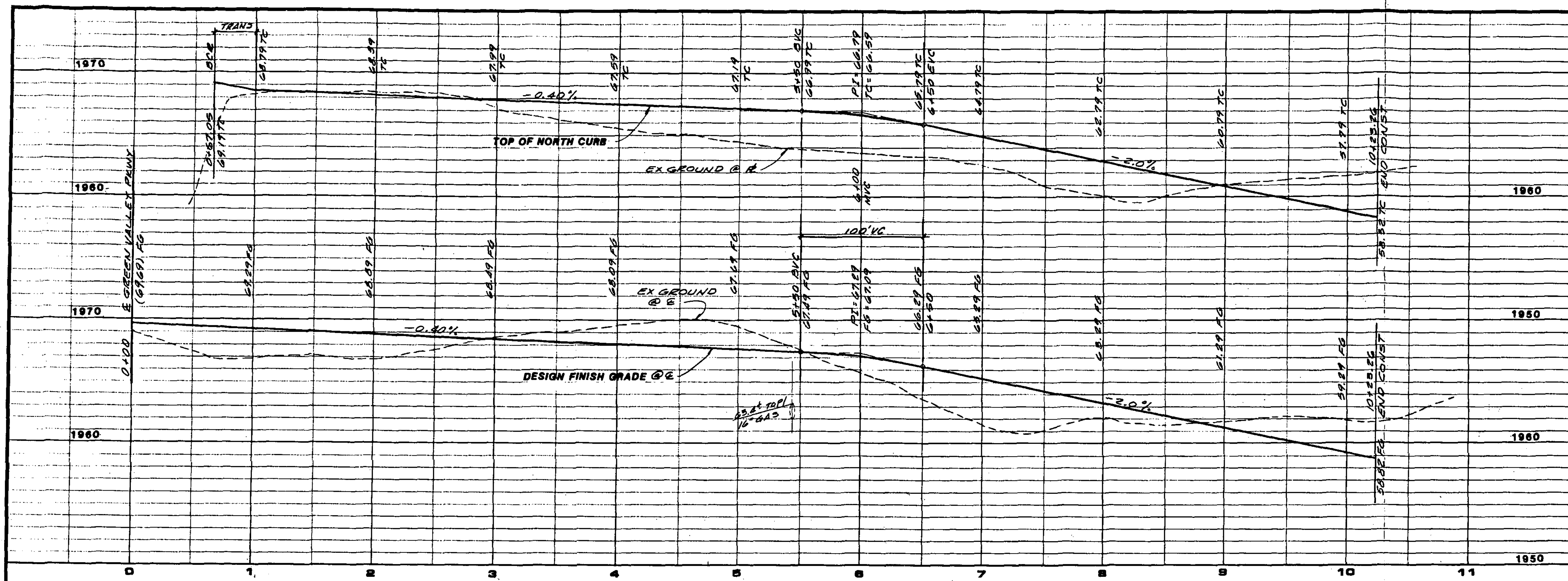
TITLE: STREET PLAN & PROFILE
GREEN VALLEY PARKWAY

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO. 3354
BY emp
DATE
SCALE HORIZ. 1":40' VERT. 1":4'

SHEET 5 OF 12 SHEETS

02827



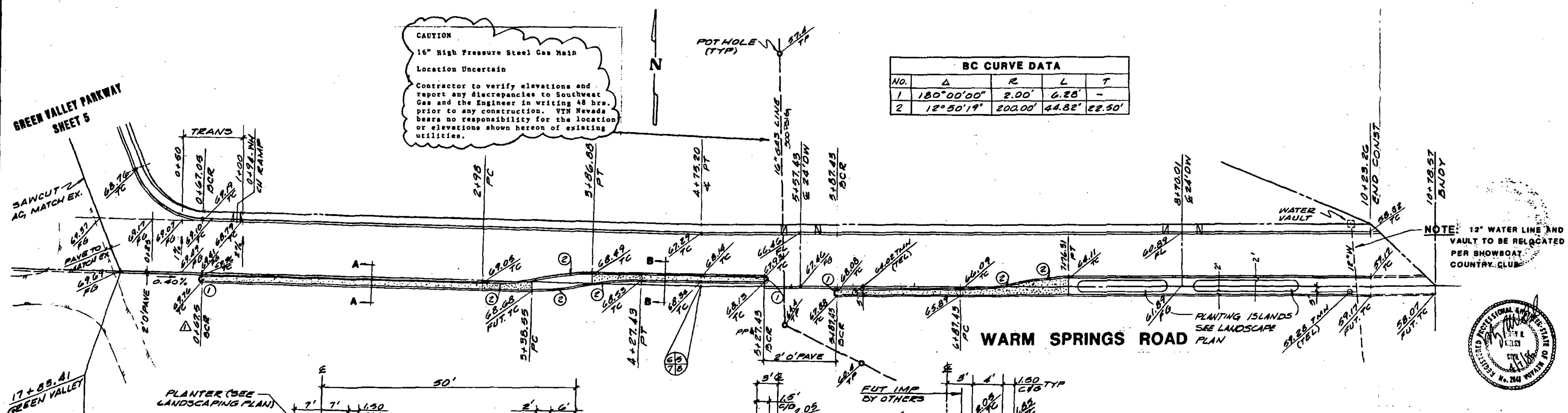
CAUTION

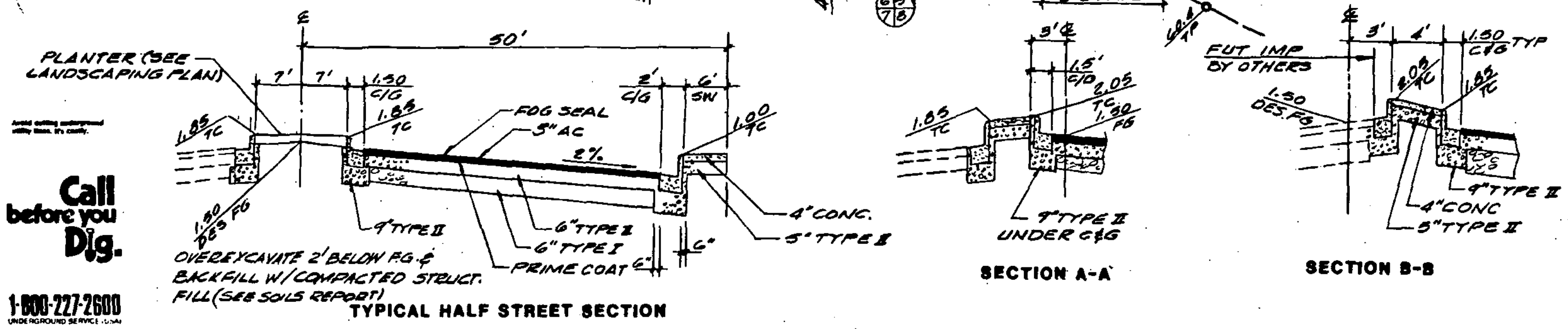
16" High Pressure Steel Gas Main

Location Uncertain

Contractor to verify elevations and report any discrepancies to Southwest Gas and the Engineer in writing 48 hrs. prior to any construction. VTN Nevada bears no responsibility for the location or elevations shown hereon of existing utilities.

BC CURVE DATA				
NO.	Δ	R	L	T
1	180°00'00"	2.00'	6.28'	–
2	12°50'19"	200.00'	44.82'	22.50'





Call before you Dig.
1-800-227-2600

ALL STREET STRUCTURAL SECTIONS SHALL BE PER THE RECOMMENDATIONS OF THE SOILS ENGINEER, BASED ON CBR OR R-VALUES. NO PAVING OR BASE WORK SHALL COMMENCE UNTIL A STREET STRUCTURAL SECTION IS APPROVED BY THE CITY ENGINEER, CITY OF HENDERSON.

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY MAY 1, 1987.

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy. Elev. 1969.01

APPROVED BY

Mark T. Calhoun 5/1/86
MARK T. CALHOUN PE DATE
City Engineer, City of Henderson

REV	DATE	BY	REVISION
△	7/10/86	EMP	ISL. NOSE STA. WAS 0+98

AMERICAN RESIDENTIAL PROPERTIES

vtn nevada
CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

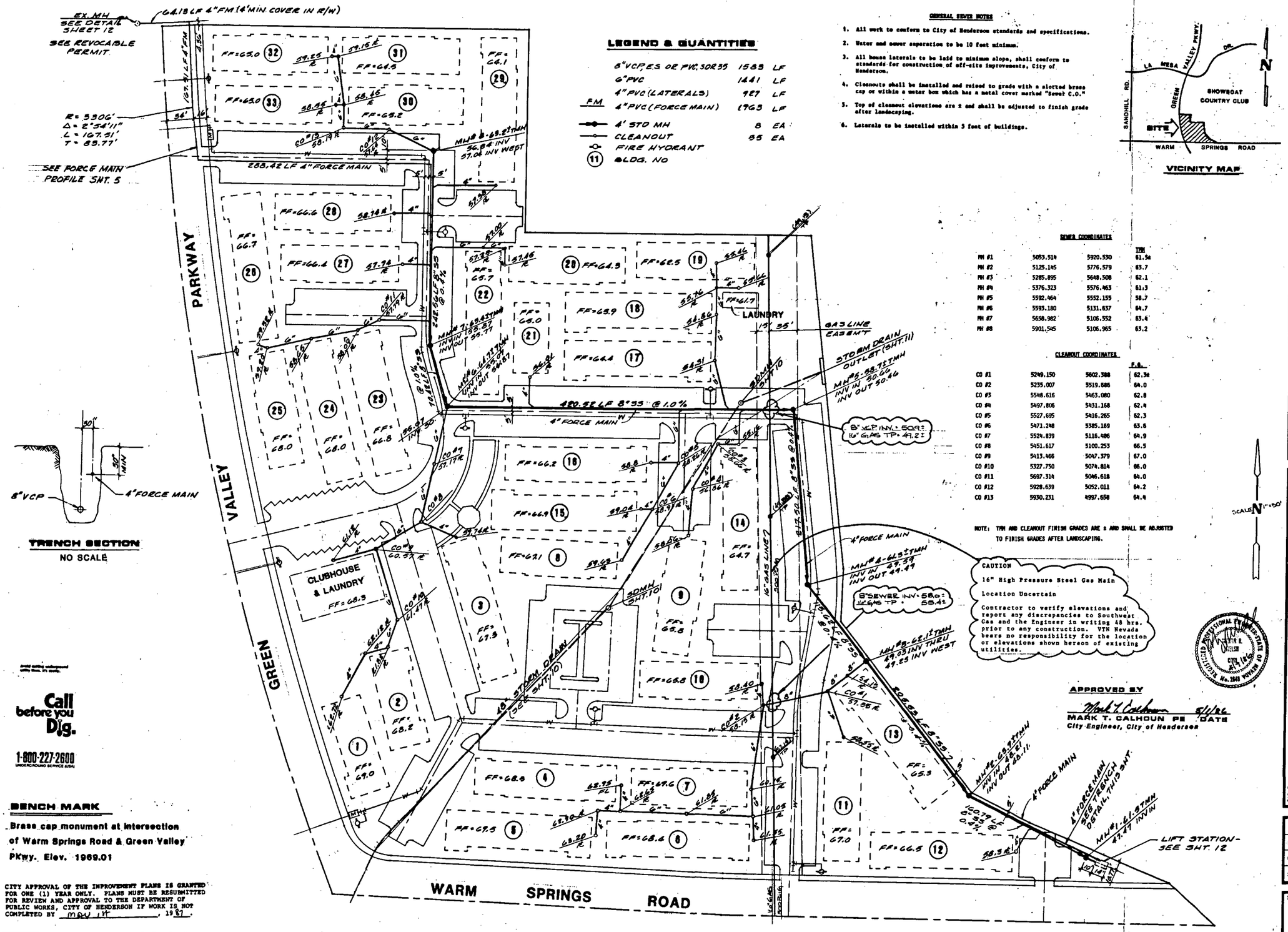
TITLE: STREET PLAN & PROFILE WARM SPRINGS ROAD

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO.	3354
BY	emp
DATE	
SCALE	HORIZ. 1":40' VERT. 1":4'

SHEET 6 OF 12 SHEETS

Φ2827



LEGEND & QUANTITIES

	8" VCP E.S. OR PVC, SDR 35	1583 LF
	6" PVC	1441 LF
	4" PVC (LATERALS)	927 LF
FM	4" PVC (FORCE MAIN)	1763 LF
	4' STD MH	8 EA
	CLEANOUT	55 EA
	FIRE HYDRANT	
(11)	BLDG. NO	

GENERAL SEWER NOTES

1. All work to conform to City of Henderson standards and specifications.
2. Water and sewer separation to be 10 feet minimum.
3. All house laterals to be laid to minimum slope, shall conform to standards for construction of off-site improvements, City of Henderson.
4. Cleanouts shall be installed and raised to grade with a slotted brass cap or within a water box which has a metal cover marked "Sewer C.O."
5. Top of cleanout elevations are ± and shall be adjusted to finish grade after landscaping.
6. Laterals to be installed within 3 feet of buildings.

SEWER COORDINATES

			TRH
MH #1	5053.514	5920.930	61.5±
MH #2	5125.145	5776.579	63.7
MH #3	5285.895	5648.508	62.1
MH #4	5376.323	5576.463	61.3
MH #5	5592.464	5552.155	58.7
MH #6	5593.180	5131.637	64.7
MH #7	5658.982	5106.552	63.4
MH #8	5901.545	5106.965	63.2

CLEANOUT COORDINATES

			F.G.
CO #1	5249.150	5602.588	62.3±
CO #2	5235.007	5519.686	64.0
CO #3	5548.616	5463.080	62.8
CO #4	5497.806	5431.168	62.4
CO #5	5527.695	5416.265	62.3
CO #6	5471.248	5385.169	63.6
CO #7	5524.839	5116.486	64.9
CO #8	5451.617	5100.253	66.5
CO #9	5413.466	5047.379	67.0
CO #10	5327.750	5074.814	66.0
CO #11	5697.314	5046.618	64.0
CO #12	5928.639	5052.011	64.2
CO #13	5930.231	4997.658	64.4

NOTE: TRH AND CLEANOUT FINISH GRADES ARE ± AND SHALL BE ADJUSTED TO FINISH GRADES AFTER LANDSCAPING.

CAUTION

16" High Pressure Steel Gas Main

Location Uncertain

Contractor to verify elevations and report any discrepancies to Southwest Gas and the Engineer in writing 48 hrs. prior to any construction. VTN Nevada bears no responsibility for the location or elevations shown hereon of existing utilities.

APPROVED BY

Mark T. Calhoun 6/11/86

MARK T. CALHOUN PE DATE

City Engineer, City of Henderson

TRENCH SECTION

NO SCALE

Call before you Dig.

1-800-227-2600

UNDERGROUND SERVICE ALERT

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy. Elev. 1969.01

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY MAY 1st, 1987.

VTN nevada

CONSULTING ENGINEERS • PLANNERS

2300 PASEO DEL PRADO BUILDING A SUITE 100

LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

REV	DATE	BY	REVISION

AMERICAN RESIDENTIAL PROPERTIES

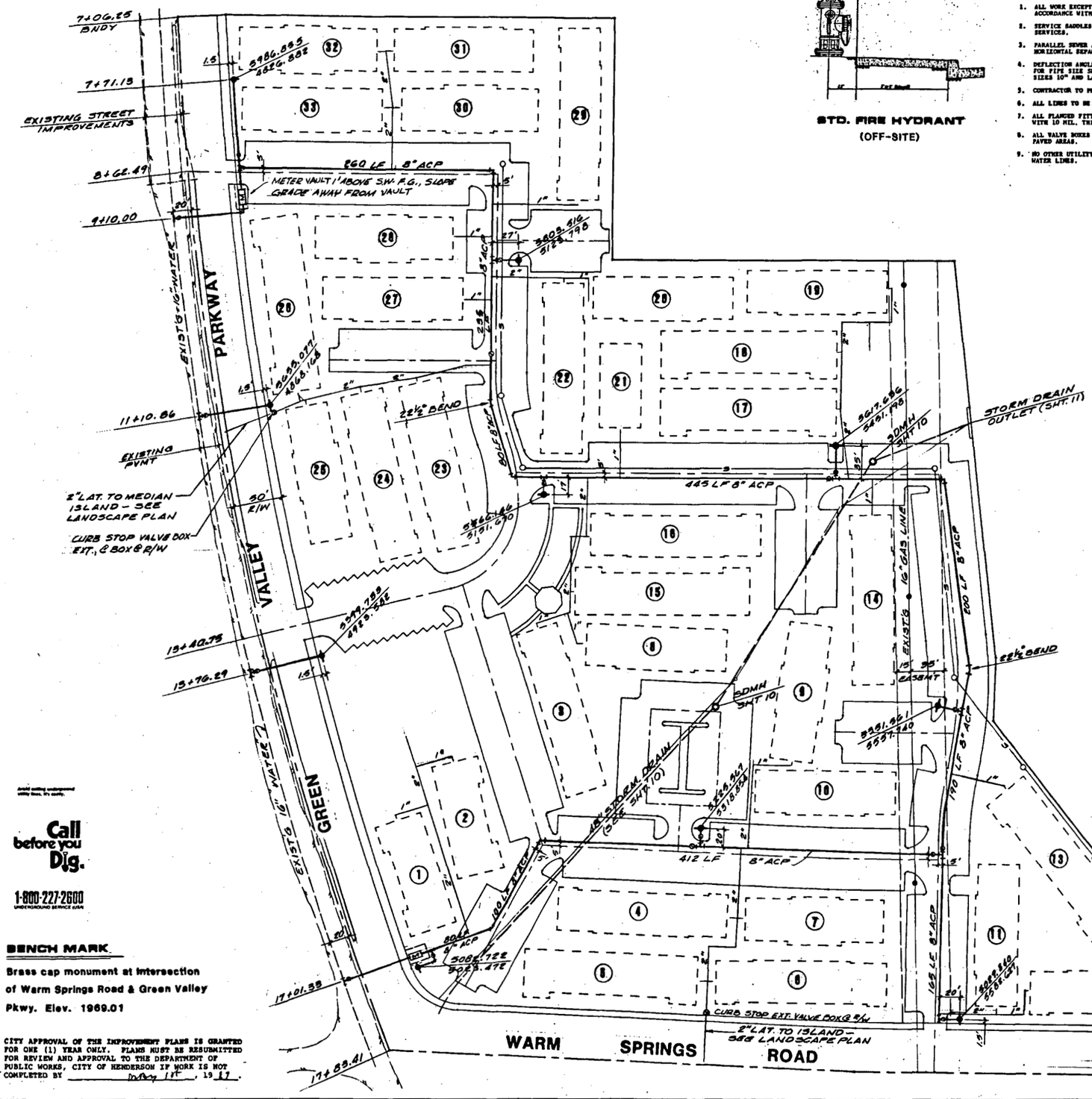
TITLE: MASTER SEWER PLAN

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO	3354
BY	emp
DATE	
SCALE	1" : 50'

SHEET 7 OF 12 SHEETS

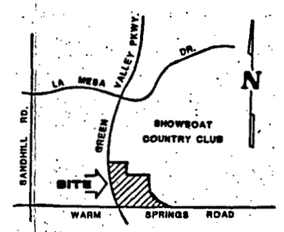
D2827



STD. FIRE HYDRANT
(OFF-SITE)

CITY OF HENDERSON WATER NOTES

1. ALL WORK EXCEPT AS MODIFIED HEREON SHALL BE DONE IN STRICT ACCORDANCE WITH THE CITY OF HENDERSON'S STANDARD SPECIFICATIONS.
2. SERVICE SADDLES OR TAPPED COLLARS WILL BE REQUIRED ON ALL SERVICES.
3. PARALLEL SEWER AND WATER LINES SHALL HAVE A MINIMUM OF 10 FEET HORIZONTAL SEPARATION.
4. DEFLECTION ANGLE SHALL NOT EXCEED 5° PER 13 FOOT SECTION OF PIPE FOR PIPE SIZE SMALLER THAN 10" AND SHALL NOT EXCEED 3° FOR PIPE SIZES 10" AND LARGER.
5. CONTRACTOR TO PROVIDE THRUST BLOCKS AS REQUIRED.
6. ALL LINES TO BE PRESSURE TESTED TO 200 PSI.
7. ALL FLANGED FITTINGS TO BE COATED WITH H.C.-244 AND WRAPPED WITH 10 MIL. THICK POLYETHYLENE.
8. ALL VALVE BOXES SHALL HAVE CONCRETE COLLARS AT SURFACE OF PAVED AREAS.
9. NO OTHER UTILITY LINES MAY BE PLACED IN THE SAME TRENCH WITH WATER LINES.



VICINITY MAP

LEGEND & QUANTITIES

⊕	FIRE HYDRANT *	10 EA
⊸	GATE VALVE (8")	10 EA
⊠	METER **	2 EA
	8"- 90° BEND	5 EA
	8"- 45° BEND	2 EA
	8"- 22½° BEND	5 EA
	8" TEE	1 EA
	16"x8" TAPPING SLEEVE	5 EA
	8" ACP CL150, OR PVC CL150 (AWWA C900)	2532 LF
	2" SERVICE	1229 LF
	1" SERVICE	745 LF

* INCLUDES 6" G.V., PIPE, TEE & FITTINGS (ON-SITE ONLY)
** 8"x4" FMCT W/O BYPASS - SEE COH STD PG. 101

APPROVED BY

Mark T. Calhoun PE
MARK T. CALHOUN PE DATE
City Engineer, City of Henderson

DALE STARR, Fire Chief Date

Call before you Dig.
1-800-227-2600
UNDERGROUND SERVICE (USA)

BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy. Elev. 1969.01

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY May 1st, 19 87.

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

REV	DATE	BY	REVISION

AMERICAN RESIDENTIAL PROPERTIES

vtn nevada

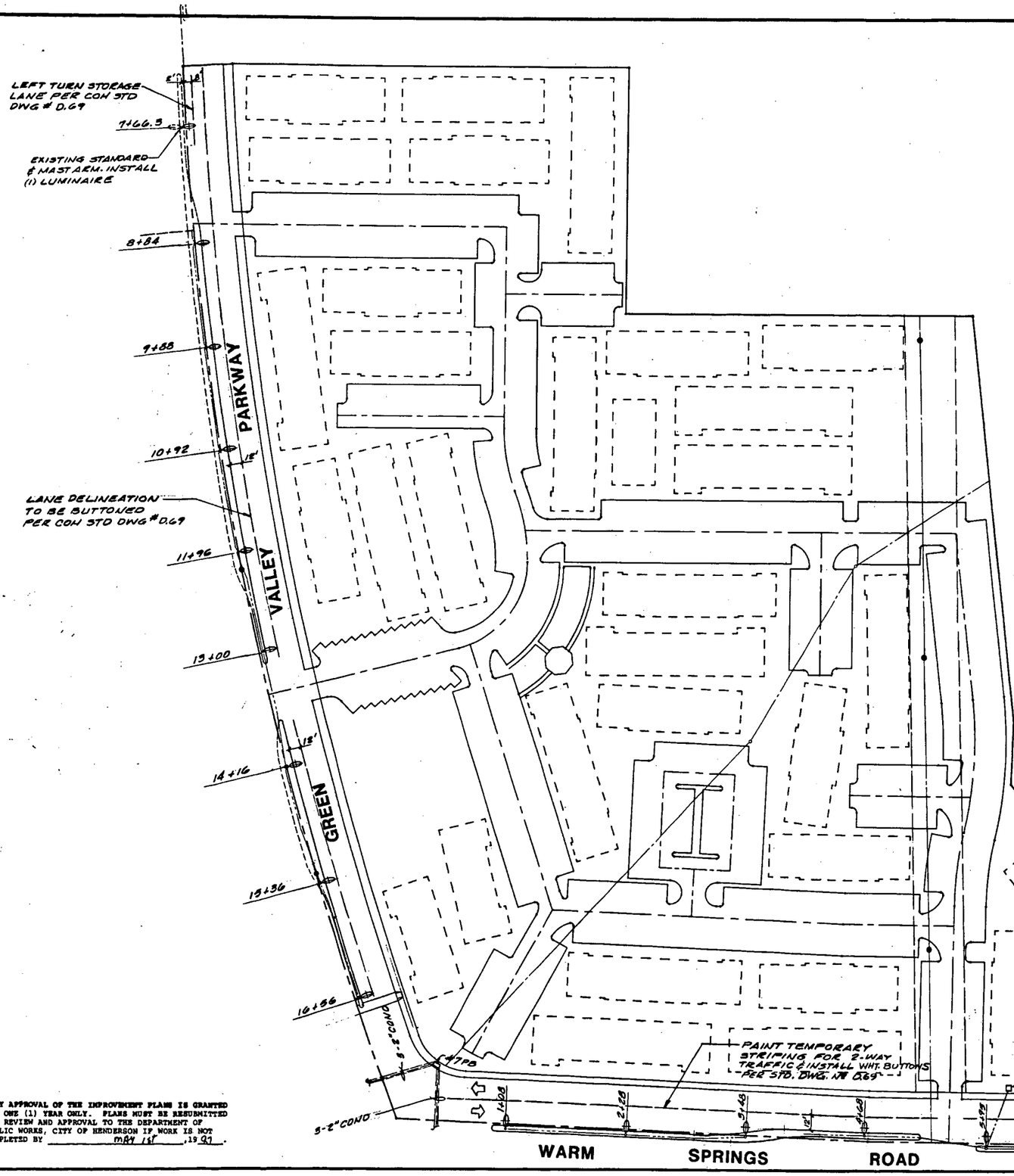
TITLE: MASTER WATER PLAN

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO	3354
BY	emp
DATE	
SCALE	1" : 50'

SHEET 8 OF 12 SHEETS

Ø2827



HENDERSON STREET LIGHTING SPECIFICATIONS (GREEN VALLEY ONLY)

STREET LIGHT INSTALLATION SHALL BE IN ACCORDANCE WITH THE CITY OF HENDERSON STANDARD DRAWINGS (1-18-79), UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFFSITE IMPROVEMENTS, CLARK COUNTY AREA (1978), AND THE NATIONAL ELECTRIC CODE.

THE STREET LIGHTING CIRCUIT SHALL BE 240V, 1Ø, 3W (NO. 4 THW COPPER WIRE & NO. 10 GREEN.

THE CONTRACTOR SHALL INSTALL THE SERVICE POINT (HENDERSON STD. DWG. NO. 623L.0204) COMPLETE INCLUDING THE CONNECTION TO THE NEVADA POWER COMPANY SERVICE. THE SERVICE RUN SHALL BE 120/240V, 1Ø, 3W (2-NO. 2, 1-NO. 4 THW COPPER OR 2-NO. 1/0, 1-NO. 2 ALUMINUM WIRE.

FIELD LOCATION OF THE STREET LIGHTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, IN ACCORDANCE WITH THE PLANS. FIELD LOCATIONS SHALL BE INSPECTED BY THE CITY PRIOR TO DIGGING THE FOUNDATIONS.

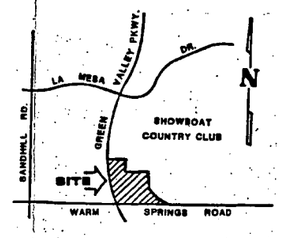
SIGN PRESSURE SODIUM LUMINAIRES FOR 51 FT. OR 60 FT. R/W STREETS SHALL BE 100 WATT, 240 VOLT, I.E.S. DISTRIBUTION TYPE II, LAMP HPS 100 WATT, CLEAR, 8800 INITIAL LUMENS, RATED LIFE 24,000 HRS AND FOR 80 FT. OR 100 FT. R/W STREETS SHALL BE 250 WATT, 240 VOLT, I.E.S. DISTRIBUTION TYPE III, LAMP H.P.S. 250 WATT, CLEAR, 50,000 INITIAL LUMENS, RATED LIFE 24,000 HRS., AND ALL SHALL HAVE AN INTEGRAL CONSTANT WATTAGE BALLAST, AND A GLASS OR ACRYLIC REFRACTOR.

STREET LIGHT POLES SHALL BE CONCRETE WITH EXPOSED AGGREGATE (BLACK AND WHITE) LOCATED BEHIND THE SIDEWALK, AND HAVE A 60-INCH DEEP FOUNDATION. THE CRABB CAP (TOP 4-6 INCHES OF THE FOUNDATION) SHALL COVER THE ENTIRE ANCHOR RODS AS PER THE FIELD ENGINEER.

SERVICE POINTS SHALL BE PER HENDERSON STANDARD DRAWINGS NO. 623L.0201 AND LOCATED BEHIND THE SIDEWALK.

A NO. 10 GREEN WIRE "EQUIPMENT GROUND" SHALL CONNECT THE METAL ARM TO THE GROUND WIRE IN THE BOTTOM OF THE POLE.

WHERE THE STREETS END AT THE UNIT BNDY, 2 END OF ROADWAY, 18" DIAMOND REFLECTORISED RED PANELS SHALL BE INSTALLED UNTIL NEXT UNIT IS INSTALLED.



VICINITY MAP

LEGEND & QUANTITIES

	EXISTING LUMINAIRE	
	250 WATT HPS LUMINAIRE	17 EA
———	1½" PVC CONDUIT	4,704 LF
◇	END OF ROAD SIGN	3 EA
▲	TRAFFIC CONTROL SIGN	EA
⬡	STOP SIGN	EA
⌐	STREET SIGN	EA

SCALE 1" = 50'

NOTE:
DOUBLE MAST ARM LIGHTING STANDARD PER CON# 623L.0046 W/(1) MAST ARM ONLY. LOCATE AS SHOWN

APPROVALS

NEVADA POWER COMPANY DATE

Mark T. Calhoun 5/1/96
MARK T. CALHOUN PE DATE
City Engineer, City of Henderson

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY May 1st, 1997.

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

REV | DATE | BY | REVISION

AMERICAN RESIDENTIAL PROPERTIES

vtn nevada

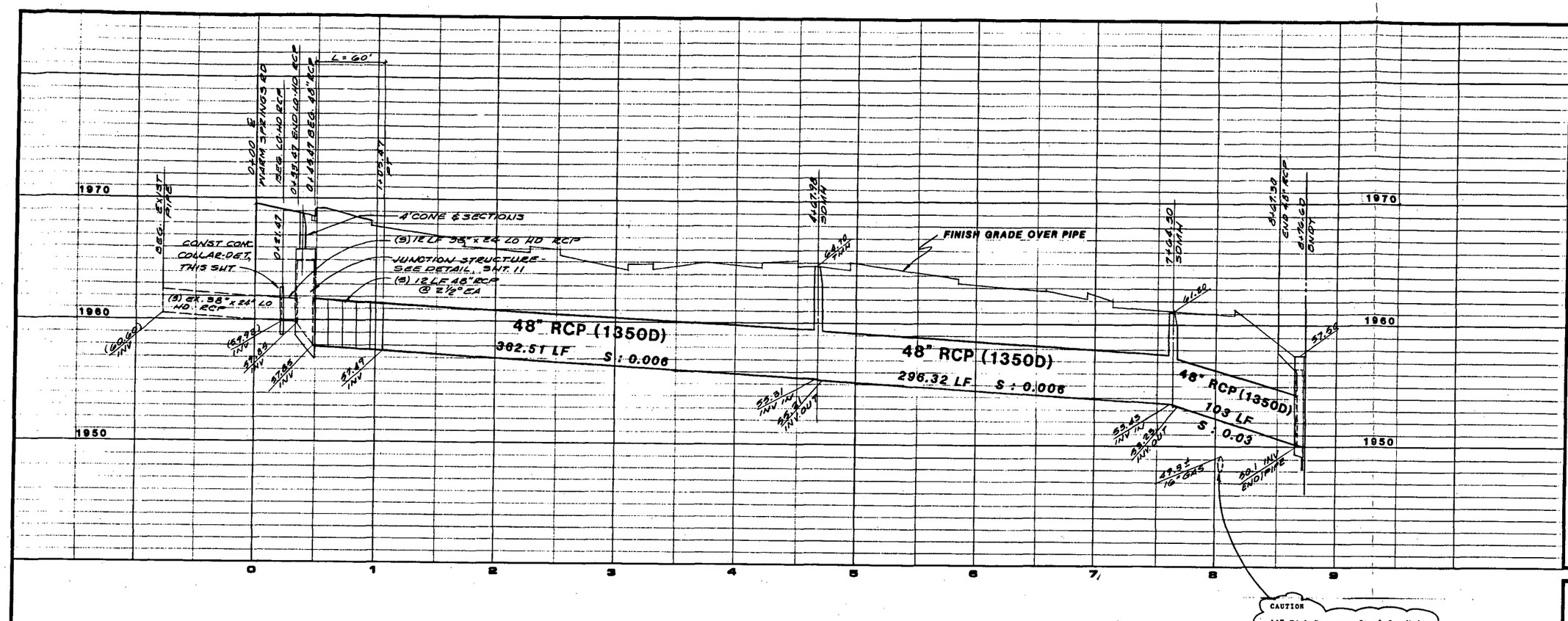
TITLE: STREET LIGHT PLAN

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO 3354
BY emp
DATE
SCALE 1" : 50'

SHEET 9 OF 12 SHEETS

Ø2827



BENCH MARK

Brass cap monument at intersection of Warm Springs Road & Green Valley Pkwy., Elev. 1969.01

BASIS OF BEARINGS

N 00° 35' 51"E, The West line of the SW 1/4 of Section 5, T 22 S, R 62 E, MDM, as shown on Parcel Map, File 36, Page 25, Clark County Records, Nevada.

CITY APPROVAL OF THE IMPROVEMENT PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON IF WORK IS NOT COMPLETED BY May 1, 1987.

APPROVED BY

Mark T. Calhoun 5/1/86

MARK T. CALHOUN PE DATE

City Engineer, City of Henderson

Call before you Dig. 1-800-227-2600 UNDERGROUND SERVICE ALERT

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

vtn nevada

AMERICAN RESIDENTIAL PROPERTIES

REV	DATE	BY	REVISION

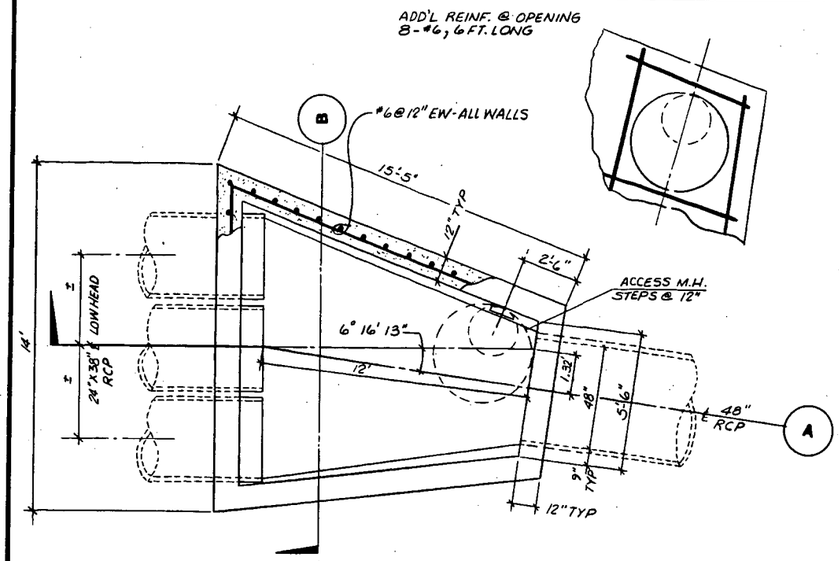
TITLE: PLAN & PROFILE STORM DRAIN

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO.	3354
BY	emp
DATE	
SCALE	HORIZ. 1" : 40 VERT. 1" : 4'

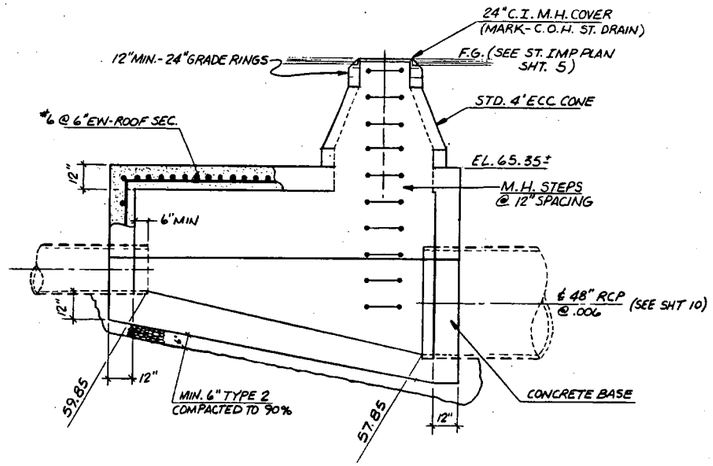
SHEET 10 OF 12 SHEETS

Ø2827



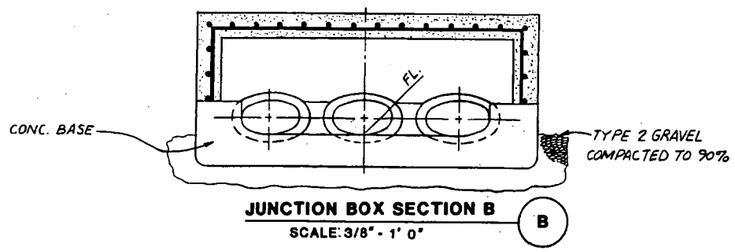
JUNCTION BOX PLAN

SCALE: 3/8" = 1' 0"



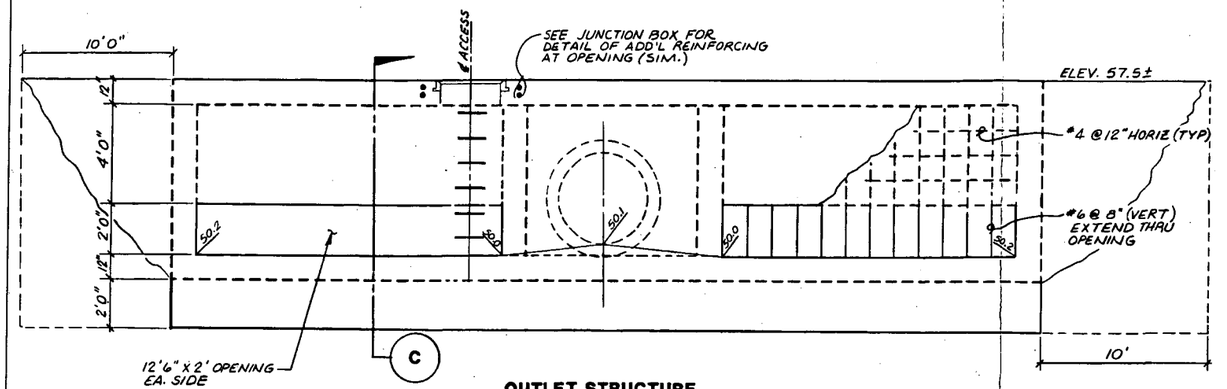
JUNCTION BOX SECTION A (A)

SCALE: 3/8" = 1' 0"



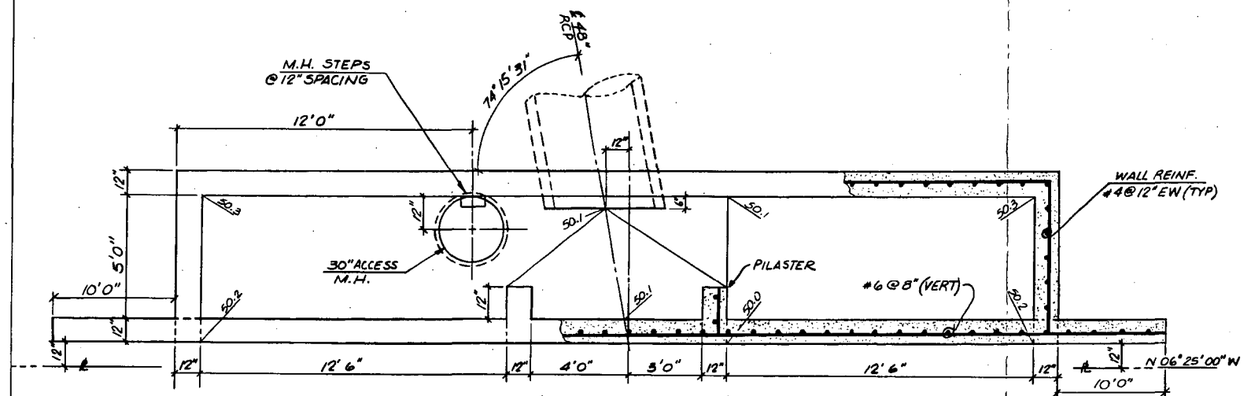
JUNCTION BOX SECTION B (B)

SCALE: 3/8" - 1' 0"



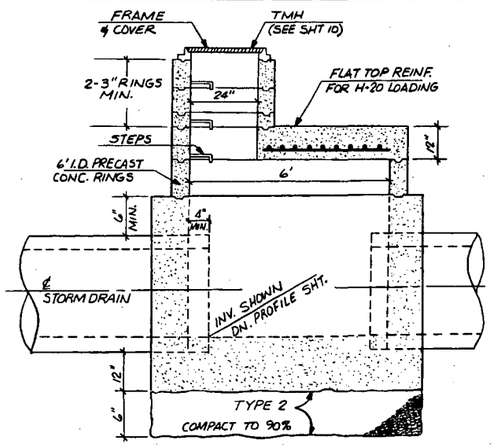
OUTLET STRUCTURE ELEVATION

SCALE: 3/8" = 1' 0"



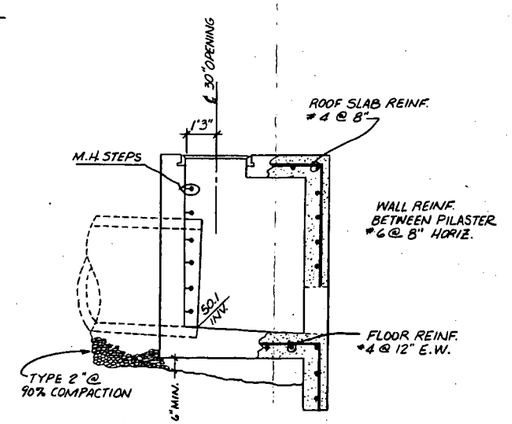
OUTLET STRUCTURE PLAN VIEW

SCALE: 3/8" = 1' 0"



6 FT. DIAM. MANHOLE

NO SCALE



OUTLET STRUCTURE SECTION C (C)

REV | DATE | BY | REVISION

AMERICAN RESIDENTIAL PROPERTIES

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550

vtn nevada

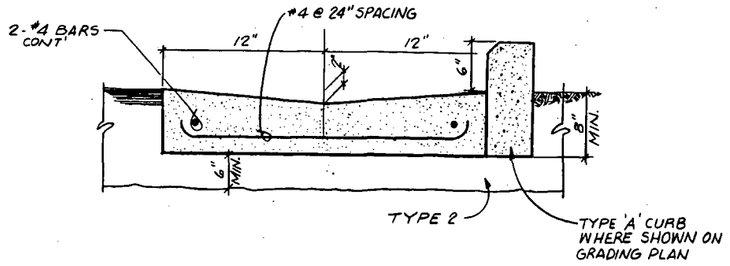
TITLE: STORM DRAIN DETAILS

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO.	3354
BY	tony r.
DATE	
SCALE	AS NOTED

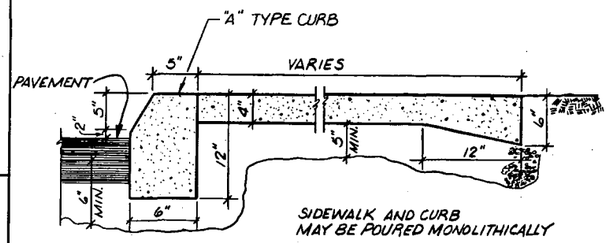
SHEET 11 OF 12 SHEETS

Ø2827



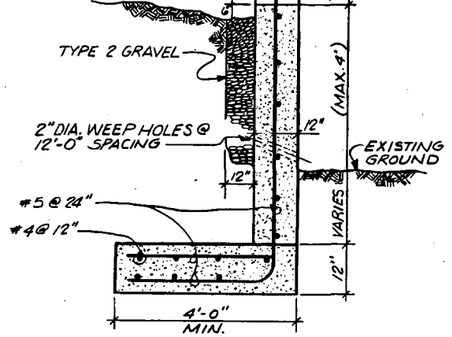
2' FT. VALLEY GUTTER (1/12)

NO SCALE



RAISED CONCRETE DETAIL
SIDEWALKS, PARKING ISLANDS, ETC.

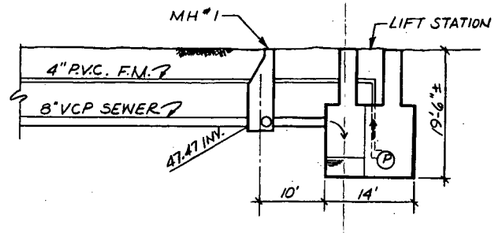
NO SCALE



RETAINING WALL

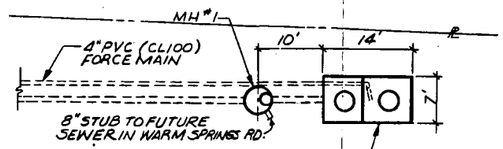
NO SCALE

FORCE MAIN SHALL BE CL. 100, SDR 25 IAW AWWA C 900, PRESSURE TESTED TO 100 PSI.



PROFILE
SEWER LIFT STATION DETAIL

NO SCALE

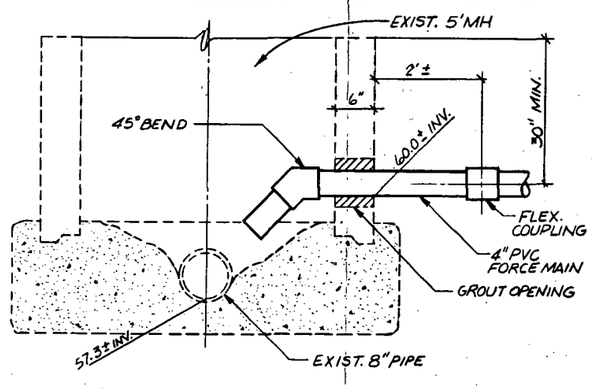


PLAN
SEWER LIFT STATION DETAIL

NO SCALE

NOTE: LIFT STATION SHOP DRAWINGS SHALL BE REVIEWED BY C.O.M. BLDG. DEPT.

LIFT STATION
DRY PIT, DUAL PUMPS
(150 GPM EA) 230V, 3Ø,
TDH - 90 FT. @ 150 gpm.
FLOAT CONTROL
"MARPAK" BY MAROLF, INC.
OR APP'D EQUAL.



FORCE MAIN CONNECTION AT M.H.

NO SCALE

REV	DATE	BY	REVISION

AMERICAN RESIDENTIAL PROPERTIES

CONSULTING ENGINEERS • PLANNERS
2300 PASEO DEL PRADO BUILDING A SUITE 100
LAS VEGAS, NEVADA 89102 PHONE (702) 873-7550
vtn nevada

TITLE: MISCELLANEOUS DETAILS

PROJECT: THE CROSSING AT GREEN VALLEY

WO NO.	3354
BY	tony r
DATE	
SCALE	NOTED

SHEET 12 OF 12 SHEETS

Ø2827

UPRR Channel LOMR

Incorporated

Federal Emergency Management Agency

Washington, D.C. 20472

RECEIVED

OCT 04 1993

MAYOR & COUNCIL
CITY OF HENDERSON

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 93-09-601P

The Honorable Robert Groesbeck
Mayor, City of Henderson
240 Water Street
Henderson, Nevada 89015

Community: City of Henderson, Nevada
FIRM Panel Numbers: 320005 0005 B,
0010 B, 0015 B
Effective Date
of This Revision: SEP 28 1993

102A

Dear Mayor Groesbeck:

This is in response to a letter dated August 18, 1993, from Mr. David W. Trushaw, VTN Nevada, regarding the effective Flood Insurance Rate Map (FIRM) for the City of Henderson, Nevada. With his August 18 letter, Mr. Trushaw submitted additional data to support his June 18, 1993, request for a Letter of Map Revision (LOMR). In his letter, Mr. Trushaw requested that we revise the effective FIRM to show the effects of the construction of a channel along the Union Pacific Railroad (UPR) on the 100-year floodplain delineation of the tributaries to Pittman Wash from 600 feet upstream to 1,300 feet downstream of Lamb Boulevard. The channel has been constructed from approximately 4,000 feet upstream of Lamb Boulevard to the confluence with Pittman Wash. All of the data required to complete our review of this request were submitted with Mr. Trushaw's June 18, June 24, July 13, and August 18, 1993, letters.

With Mr. Trushaw's July 13 letter, he provided certification from Mr. Curt Chandler, City of Henderson, that this project is sponsored by the City and is intended for flood loss reduction to existing development in identified flood hazard areas. This certification meets the requirements of Paragraph 72.5(c) of the National Flood Insurance Program (NFIP) regulations, and accordingly, the fees associated with our review and map processing have been waived.

We have completed our review of the submitted data, and have revised the FIRM to modify the floodplain boundary delineations of a flood having a 1-percent probability of being equaled or exceeded in any given year (base flood) along the tributaries to Pittman Wash. As a result of this revision, the Special Flood Hazard Area (SFHA) designation has been removed from these tributaries and added along UPR channel from approximately 600 feet upstream to 3,100 feet downstream of Lamb Boulevard. At the downstream limit of this revision, the 100-year floodplain boundaries tie-in to the 100-year floodplain boundaries shown for another tributary to Pittman Wash.

The modification is shown on the enclosed annotated copy of FIRM Panels 320005 0005 B, 0010 B and 0015 B. This LOMR hereby revises these panels of the effective FIRM dated June 15, 1982. A preliminary copy of this panel was issued on July 29, 1993, for review by your community. We will incorporate

the modifications described in this LOMR into the revised map before it becomes effective.

This modification has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and is in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR, Part 65.

As required by the legislation, a community must adopt and enforce floodplain management measures to ensure continued eligibility to participate in the NFIP. Therefore, your community must enforce these regulations using, at a minimum, the base flood elevations, zone designations, and floodways in the SFHAs shown on the FIRM for your community, including the previously described modifications.

This response to your request is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all proposed floodplain developments, including this request, and for ensuring that necessary permits required by Federal or State law have been received. With knowledge of local conditions and in the interest of safety, State and community officials may set higher standards for construction, or may limit development in floodplain areas. If the State of Nevada or the City of Henderson has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP requirements.

The basis of this LOMR is a channel-modification project. NFIP regulations, as cited in Paragraph 60.3(b)(7), require that communities assure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management regulations. Consequently, the ultimate responsibility for maintenance of the channel modification rests with your community.

The community number and suffix code listed above will be used for all flood insurance policies and renewals issued for your community on and after the effective date listed above.

The modifications described herein are effective as of the date of this letter. However, a review of the modifications and any requests for changes should be made within 30 days. Any request for reconsideration must be based on scientific or technical data.

This LOMR will not be printed and distributed to primary map users such as local insurance agents and mortgage lenders; therefore, your community will serve as a repository for these new data. We encourage you to disseminate the information reflected by this LOMR widely throughout your community in order that interested persons, such as property owners, insurance agents, and mortgage lenders, may benefit from this information. We also encourage you to consider preparing an article for publication in your community's local newspaper that would describe the changes that have been made and the assistance your community will provide in serving as a clearinghouse for these data and interpreting NFIP maps.

If you have any questions regarding the modifications described herein, please contact the Chief, Natural and Technological Hazards Division, Federal Emergency Management Agency, in San Francisco, California, at (415) 923-7175, or Mr. John Magnotti of my staff in Washington, DC, at (202) 646-3932, or by facsimile at (202) 646-3445.

Sincerely,

William R. Locke
Chief, Risk Studies Division
Federal Insurance Administration

Enclosures

cc: Mr. Curt Chandler
Land Development Manager
City of Henderson

Mr. Gale Wm. Fraser II, P.E.
Assistant General Manager

Mr. David W. Trushaw
VTN Nevada

APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
HENDERSON, NEVADA
CLARK COUNTY

PANEL 5 OF 25

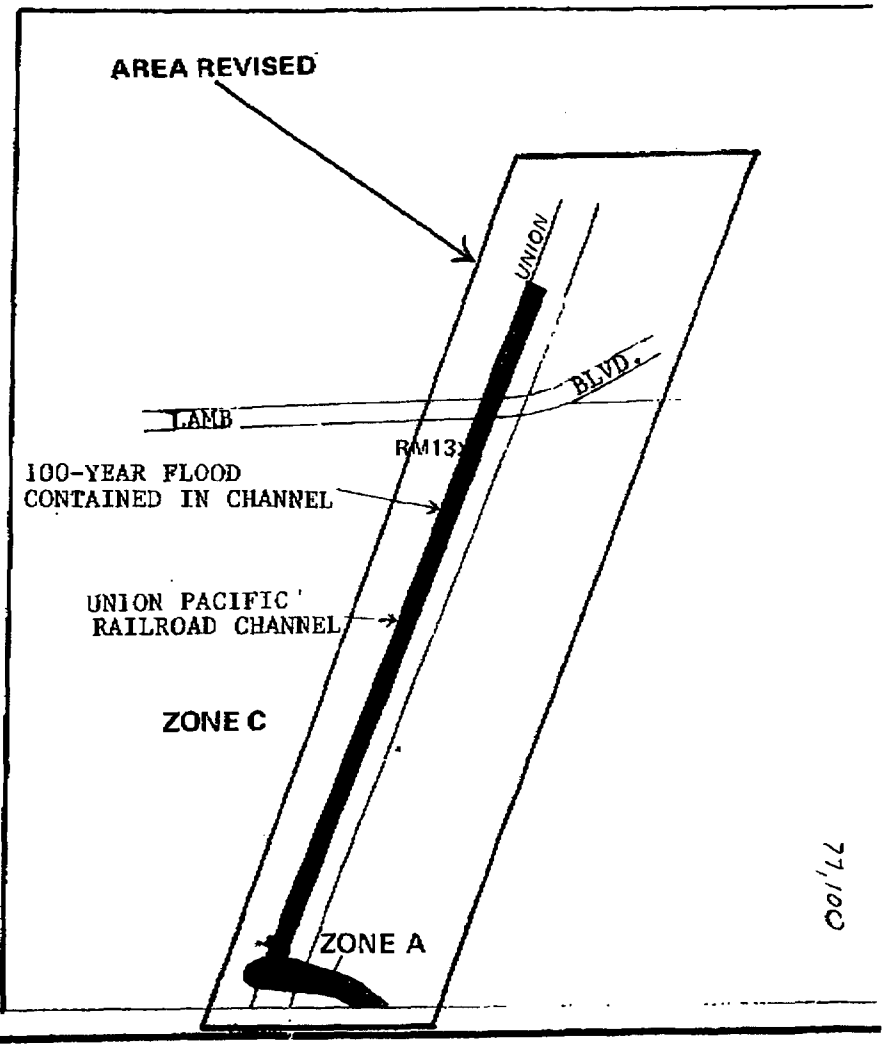
REVISED TO REFLECT LOMR

DATED SEP 2 8 1998

COMMUNITY-PANEL NUMBER
320005 0005 B

EFFECTIVE DATE:
JUNE 15, 1982

Federal Emergency Management Agency



77/10C

JOINS PANEL 0010

101

INSET A

APPROXIMATE SCALE
1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
HENDERSON, NEVADA
CLARK COUNTY

PANEL 5 OF 25
(PANELS NOT PRINTED)

REVISED TO REFLECT LOMR DATED SEP 2 8 1993

COMMUNITY-PANEL NUMBER
320005 0005 B

EFFECTIVE DATE:
JUNE 15, 1982

Federal Emergency Management Agency

ADJOINING AREA SHOWN ON PANEL 320005 0005 B

AREA REVISED

ZONE C

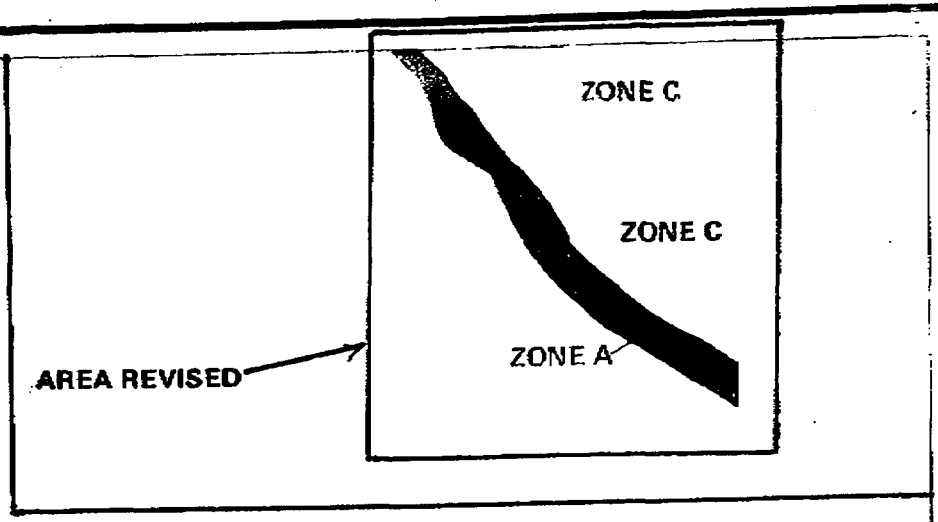
ZONE C

HIGH VISTA CIR

ZONE C

ADJOINING AREA SHOWN ON PANEL 320005 0015 B

JOINS PANEL 0005



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
HENDERSON, NEVADA
CLARK COUNTY

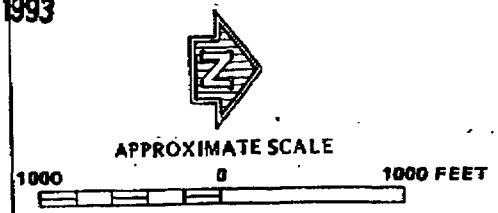
PANEL 10 OF 25
[PANELS PRINTED]

REVISED TO REFLECT LOMR DATED SEP 2 8 1993

COMMUNITY-PANEL NUMBER
320005 0010 B

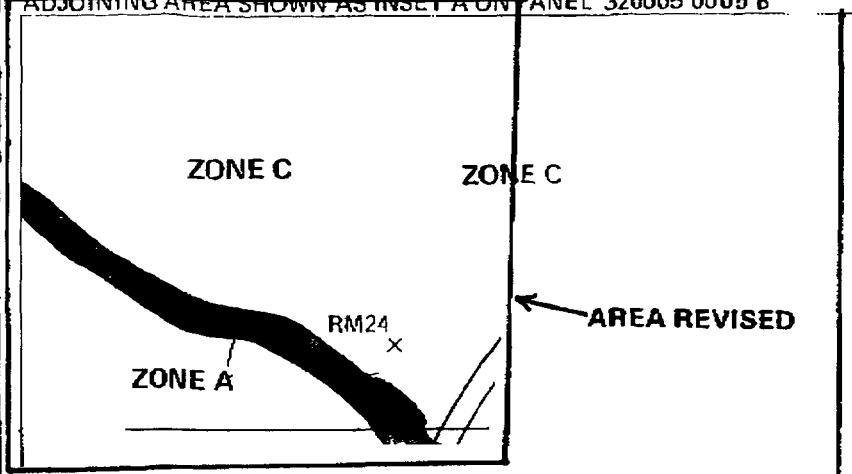
EFFECTIVE DATE:
JUNE 15, 1982

Federal Emergency Management Agency



JOINS PANEL 0015

ADJOINING AREA SHOWN AS INSET A ON PANEL 320005 0005 B



JOINS PANEL 0010

APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
HENDERSON, NEVADA
CLARK COUNTY

PANEL 15 OF 25

REVISED TO REFLECT LOMR DATED SEP 2 8 1993

COMMUNITY-PANEL NUMBER
320005 0015 B

EFFECTIVE DATE:
JUNE 15, 1982

Federal Emergency Management Agency

Incorporated

Federal Emergency Management Agency

Washington, D.C. 20472

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Robert Groesbeck
Mayor, City of Henderson
240 Water Street
Henderson, Nevada 89015

IN REPLY REFER TO:
Case No.: 92-09-152P

Community: City of Henderson, Nevada
Community Panel Nos.: 320005 0005 B, 0010 B, 0015 B and 320003 1250 B
Effective Date of This Revision: JAN 12 1994

102-D

Dear Mayor Groesbeck:

77
99
100
114
120
121
122

This is in response to a request for a revision to the effective Flood Insurance Study and National Flood Insurance Program (NFIP) maps for your community. Specifically, this responds to a transmittal received on October 21, 1993, from Mr. Tom Davy, Engineers and Surveyors, Inc., regarding the effective Flood Insurance Rate Maps (FIRM) for the City of Henderson and the unincorporated areas of Clark County; however, the entire revised area has been annexed by the City of Henderson.

In his letter, Mr. Davy requested that we revise the effective FIRM to show the effects of the construction of a channel along the Union Pacific Railroad (UPRR) and development along a tributary to Pittman Wash downstream of UPRR. All of the data required to complete our review of this request were submitted with a letter dated October 21, 1993.

We have completed our review of the submitted data and the flood data shown on the effective FIRM, and have revised the FIRM to modify the floodplain boundary delineations of a flood having a 1-percent probability of being equaled or exceeded in any given year (base flood) along the Zone A tributary. As a result of this revision, the Special Flood Hazard Area (SFHA) designation has been removed from a tributary to Pittman Wash from approximately 3,500 feet downstream of Green Valley Parkway along the UPRR channel to Sunset Road. The SFHA designation has been added along the UPRR channel from approximately 3,500 feet downstream of Green Valley Parkway to approximately 3,000 feet downstream of Valle Verde Drive. In addition, the 100-year flood is contained in Warm Springs Road from approximately 6,000 feet east of Green Valley Parkway to the confluence with Pittman Wash and in Sunset Road from approximately 3,500 feet west of the confluence with Pittman Wash to the confluence with Pittman Wash.

The modifications are shown on the enclosed annotated copies of FIRM Panels 320005 0005 B, 0010 B, 0015 B, and 320003 1250 B. This Letter of Map Revision (LOMR) hereby revises these panels of the effective FIRM dated June 15, 1982, and September 27, 1989. A preliminary copy of these panels was issued on July 29, 1993, for review by your community. We will incorporate the modifications described in this LOMR into the revised FIRM before it becomes effective. Please note that the revised area on FIRM Panel 320003 1250 B is currently shown on the effective FIRM as Zone D, an area in which flood hazards are undetermined. However, flooding along Pittman Wash is shown on the above-mentioned preliminary copies of this map panel. The floodplain boundaries shown on the annotated copy along the UPRR channel, Warm Springs Road, and Sunset Road will tie into the Pittman Wash floodplain boundaries when these modifications are incorporated into the preliminary FIRMs.

The revisions are effective as of the date of this letter; however, a review of the determination made by this LOMR and any requests to alter this determination should be made within 30 days. Any request to alter the determination must be based on scientific or technical data.

This response to your request is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all proposed floodplain developments, including this request, and for ensuring that necessary permits required by Federal or State law have been received. With knowledge of local conditions and in the interest of safety, State and community officials may set higher standards for construction, or may limit development in floodplain areas. If the State of Nevada or the City of Henderson has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence.

The basis of this LOMR is, in part, a channel-modification project. NFIP regulations, as cited in Paragraph 60.3(b)(7), require that communities assure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management regulations. Consequently, the ultimate responsibility for maintenance of the channel modification rests with your community.

Because this LOMR will not be printed and distributed to primary users, such as local insurance agents and mortgage lenders, your community will serve as a repository for the new data. We encourage you to disseminate the information reflected by this LOMR widely throughout the community, so that interested persons, such as property owners, insurance agents, and mortgage lenders, may benefit from the information. We also encourage you to give consideration to preparing an article for publication in your community's local newspaper. This article should describe the changes that have been made and the assistance your community will give in providing the data and interpreting the NFIP maps.

This determination has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and is in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria are the minimum requirements and do not supersede any State or local requirements of a more stringent nature. This includes adoption of the effective FIRM to which the regulations apply and the modifications made by this LOMR.

Should you have any questions regarding this matter, please contact the Division Director, Mitigation Division of the Federal Emergency Management Agency in San Francisco, California, at (415) 923-7175, or Mr. John Magnotti of our staff in Washington, DC, at (202) 646-3932, or by facsimile at (202) 646-3445.

Sincerely,

Michael K. Buckley, P.E., Chief
Hazard Identification Branch
Mitigation Directorate

Enclosure

cc: Mr. Curt Chandler
Land Development Manager
City of Henderson

Mr. Gale Wm. Fraser II, P.E.
Chief Manager
Clark County Flood Control
District

Mr. Tom Davy
Engineers and Surveyors, Inc.

Mr. Charles D. Carter
Di Loreto Construction and
Development, Inc.

Mr. Robert Thompson
Community Development
Clark County

100

APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CITY OF
HENDERSON, NEVADA
CLARK COUNTY

PANEL 5 OF 25

REVISED TO REFLECT LOMR DATED JAN 1 2 1994

COMMUNITY-PANEL NUMBER
320005 0005 B

EFFECTIVE DATE:
JUNE 15, 1982

REVISED BY LOMR DATED SEP. 28, 1993

Federal Emergency Management Agency

JOINS PANEL 0010

AREA REVISED

ZONE C

100-YEAR FLOOD CONTAINED IN CHANNEL

UNION PACIFIC RAILROAD CHANNEL

ADJOINING AREA SHOWN AS INSET A ON PANEL 320005 0005 B

JOINS PANEL 0005

121, 120

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
HENDERSON, NEVADA
CLARK COUNTY

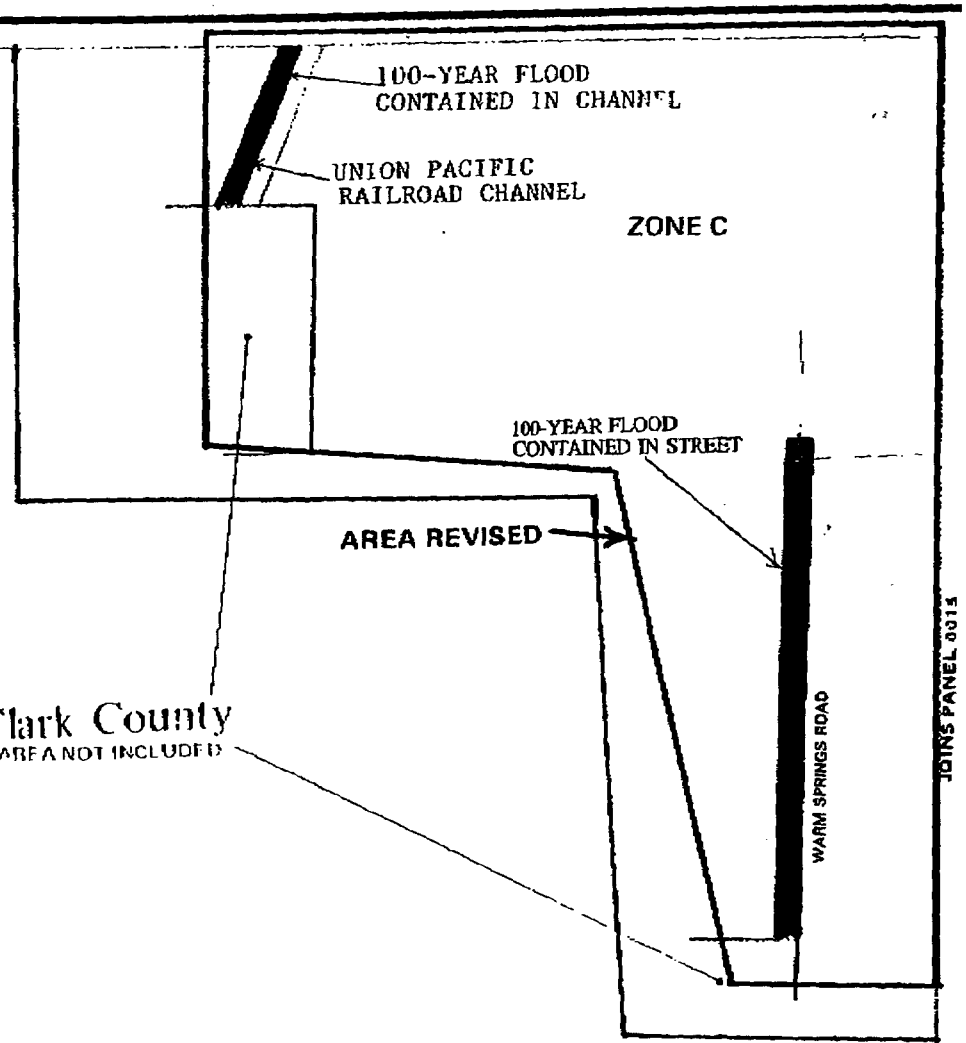
PANEL 10 OF 25

REVISED TO REFLECT LOMR DATED JAN 12 1994

COMMUNITY-PANEL NUMBER
320005 0010 B

EFFECTIVE DATE:
JUNE 15, 1982
REVISED BY LOMR
DATED SEP. 28, 1993

Federal Emergency Management Agency



APPROXIMATE SCALE
1000 0 1000 FEET

RESPONSE TO COMMENTS TO THE GREEN VALLEY AREA REQUEST FOR LETTER OF MAP REVISION

Case No.: 04-09-0954P
Community: City of Henderson, Nevada
Community No.: 320005

Prepared for:

Clark County Regional Flood Control District
500 South Grand Central Parkway
Las Vegas, NV 89155

Prepared by:

PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

Reference Number: 511542.00
July 29, 2004

PBS&J

ENGINEERING · PLANNING
CONSTRUCTION SERVICES
SURVEYING

July 29, 2004

Ms. Sheila M. Norlin
National LOMC Manager
Michael Baker Jr., Inc.
3601 Eisenhower Avenue
Alexandria, Virginia 22304-6425

RE: CASE NO.: 04-09-0954P
COMMUNITY: CITY OF HENDERSON, NV
COMMUNITY NO.: 320005

RFCD
2004 JUL 30 AM 11:56

Dear Ms. Norlin:

Submitted for your review is the Response to Comments for the Green Valley Area Request for Letter of Map Revision.

If you have any questions regarding this report, please contact our office at (702) 263-7275.

Sincerely,

PBS&J

PROFESSIONAL ENGINEER STATE OF NEVADA
MATTHEW S. BAIRD
Exp. 6/31/04
CIVIL
No. 13684

7/29/04

Brian K. Loffman, CFM
Hydrologist

Matt Baird, P.E., CFM
Program Manager

2270 Corporate Circle · Suite 100 · Henderson, Nevada 89074-6382 · Telephone 702/263-7275 · Fax 702/263-7200

The response to comments in a letter dated July 1, 2004 from Michael Baker Jr., Inc. (MBJ) are included below, see Appendix A for a copy of the comment letter.

Comment 1: **Please provide as-built plans, certified by a registered professional engineer, for the 42-inch reinforced concrete pipe (RCP) that extends from the Union Pacific railroad to a point approximately 900 feet downstream of Green Valley Parkway in the existing golf course.**

Response 1: PBS&J made several attempts to obtain the storm drain as-built plans from the City of Henderson. However, the age of the storm drain system is approximately 17 years and thus as-built plans were not readily available. Therefore, as discussed in a telephone conversation on July 13, 2004 with Mr. Alfonso Mejia of MBJ, it was decided that survey data could be provided in lieu of as-built plans provided the survey data was certified by a registered professional engineer. Please refer to Appendix B for a map showing the location of the storm drain survey points. For specific elevations and descriptions corresponding to the figure refer to Appendix C for Table 1. Included in Appendix C is a copy of the field survey data notebook. Also, refer to Appendix D for the data CD that contains both the figure and raw survey data files.

Comment 2: **It is not clear from the submitted information how the Special Flood Hazard Area (SFHA), the area subject to inundation by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood), will be removed from a point approximately 900 feet downstream of Green Valley Parkway, at the outlet of the 48-inch RCP, to a point approximately 2,100 feet downstream of Green Valley Parkway in the existing golf course. Please provide a hydraulic analysis that shows how this SFHA will be removed, or show a graphical tie-in between the proposed revision and the effective SFHA downstream of the 48-inch RCP storm drain outlet.**

Response 2: In a telephone conversation with Mr. Alfonso Mejia it was described that a normal depth cross-section at the downstream end of the golf course floodzone demonstrated a flow depth of less than 1-foot. However, it was decided to forgo any additional analysis and classify the area as a Shaded Zone X. Mr. Mejia then prepared a draft FIRM Panel annotation and forwarded it to PBS&J via fax for review. PBS&J received the draft annotation on July 21, 2004 and called Mr. Mejia on the same day to agree with the proposed floodzone delineations and Shaded Zone X classification.

Appendix A: Comment Letter

NATIONAL FLOOD INSURANCE PROGRAM

FEMA MAP COORDINATION CONTRACTOR

JUL 0 1 2004

Mr. Kevin Eubanks, P.E., CFM
Assistant General Manager
Clark County Regional Flood Control District
600 South Grand Central Parkway, Suite 300
Las Vegas, NV 89106-4511

IN REPLY REFER TO:
Case No.: 04-09-0954P
Community: City of Henderson, NV
Community No.: 320005

316-AD

Dear Mr. Eubanks:

This is in regard to your April 14, 2004, request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map for the above-referenced community.

In a previous letter, you were informed that additional data might be required to complete our review of the request. The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed below.

1. Please provide as-built plans, certified by a registered professional engineer, for the 42-inch reinforced concrete pipe (RCP) that extends from the Union Pacific railroad to a point approximately 900 feet downstream of Green Valley Parkway in the existing golf course.

2. It is not clear from the submitted information how the Special Flood Hazard Area (SFHA), the area subject to inundation by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood), will be removed from a point approximately 900 feet downstream of Green Valley Parkway, at the outlet of the existing 48-inch RCP, to a point approximately 2,100 feet downstream of Green Valley Parkway in the existing golf course. Please provide a hydraulic analysis that shows how this SFHA will be removed, or show a graphical tie-in between the proposed revision and the effective SFHA downstream of the 48-inch RCP storm drain outlet.

Please send the required data directly to us at the address shown at the bottom of this page. For identification purposes, please include the case number referenced above on all correspondence.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the flat review and processing fee for requests of this type established by the current fee schedule. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register,* is enclosed for your information.

If you are unable to meet the 90-day deadline for submittal of required items, and would like us to continue processing your request, you must request an extension of the deadline. This request must be submitted to us in writing and must provide (1) the reason why the data cannot be submitted within the requested timeframe, and (2) a new date for the submittal of the data. FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, the fees will be forfeited for any request for which neither the requested data nor a written extension request is received within 90 days.

3601 Eisenhower Avenue, Alexandria, Virginia 22304-6425 PH: 703.960.8800 FX: 703.960.9125

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please call the Revisions Coordinator for your State, Mr. Sacha Tohme, who may be reached at (703) 960-8800, ext. 3028.

Sincerely,

Sheila M. Norlin
National LOMC Manager
Michael Baker Jr., Inc.

cc: Mr. Curt Chandler, P.E.
Land Development Manager
City of Henderson

Mr. Stephen C. Altman, P.E., CFM
PBS&J

Appendix B: Survey Figure

Appendix C: Survey Data Table and Field Log

Table 1
Storm Drain Survey Data
Green Valley Area LOMR

Point No.	Northing	Easting	Elevation	Description	Misc Desc	Misc Desc
2000	26721162.5	804141.77	1983.028	CP		
2001	26720908.1	804211.31	1989.042	COH	BM145	
2999	26723098.6	803531.33	1971.142	COHBM-143		
3000	26721162.4	804141.78	1983.017	CP		
3001	26720908.1	804211.32	1988.95	COHBM-145		
3002	26721633.6	802563.2	1988.402	CP		
3003	26721785.9	802869.57	1973.743	FL-42"	CONC	PIPE
3004	26722302.1	803802.32	1976.393	COHBM-144		
3005	26722020.9	803292.38	1973.181	D-SDMH		
3006	26722019.3	803289.32	1973.161	D-DI		
3007	26722024.3	803292.09	1973.148	D-DI		
3008	26722057.7	803292.82	1974.203	INIT	PT	
3009	26722115.1	803269.88	1973.28	D-GRATE		
3010	26722174.5	803252.19	1974.483	D-SDMH		
3011	26722377.1	803270.03	1975.962	SDM-12.45		
3012	26722326.8	803631.96	1973.388	SDM-8.45		
3013	26722398.2	803653.29	1971.849	SDM-9.20		
3014	26722426.3	803669.04	1971.318	D-DI		
3015	26722429.7	803677.32	1971.307	D-DI		
3016	26722430.4	803675.23	1971.501	SDM-4.45		
3017	26722458.7	803675.75	1972.201	STM-9.80		
3018	26722478	803680.85	1970.64	SDM-5.00		
3019	26723158.5	804280.56	1961.116	GRATE-3.10		
3020	26722472.7	803684.86	1970.665	D-DI		
3021	26722480.2	803681.51	1970.503	D-DI		
3022	26723209.7	804286.96	1960.749	D-TOP-HW		
3023	26723209.4	804280.44	1960.808	D-TOP-HW		
3024	26723174.6	804284.24	1961.056	D-TOP-HW		
3025	26723175	804290.62	1960.952	D-TOP-HW		
3026	26723202.6	804287.76	1953.927	D-CLVRT-FL		
3027	26723182.6	804290.1	1954.602	D-CLVRT-FL		

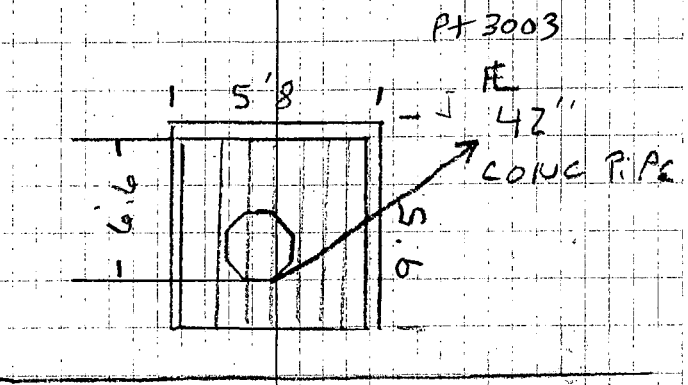
STORM DRAIN

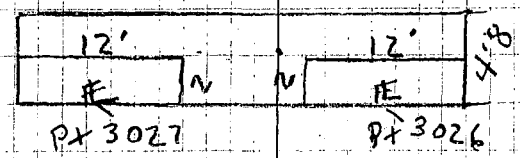
WARM SPRINGS & GREENVALLEY

7"T-DS

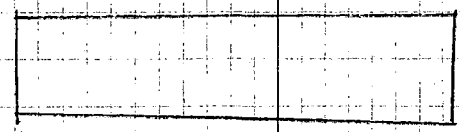
7-23-04

3003	FE CONC PIPE	
3004	CK BM 144	
3005	STORM DRAIN MH	-3.12
3009	DROP INLET	
3010	STORM MH	-8.80
3011	STORM MH	12.45
3012	STORM MH	-8.95
3013	STORM MH	-9.20
3016	STORM MH	-4.45
3017	STORM MH	-9.80
3018	STORM MH	-5.00
3019	DROP INLET	-3.10
3026	FE	
3027	FE	





FACE



Top

Headwall

		TOR RIM	DIP	ft
3005		1973.18	-3.12	
3010		1974.48	-8.80	
3011		1975.96	-12.45	
3012		1973.39	-8.45	
3013		1971.85	-9.20	
3016		1971.50	-4.45	
3017		1972.20	-9.80	
3018		1970.64	-5.00	
3019		1961.12	-3.10	

Appendix D: Data CD

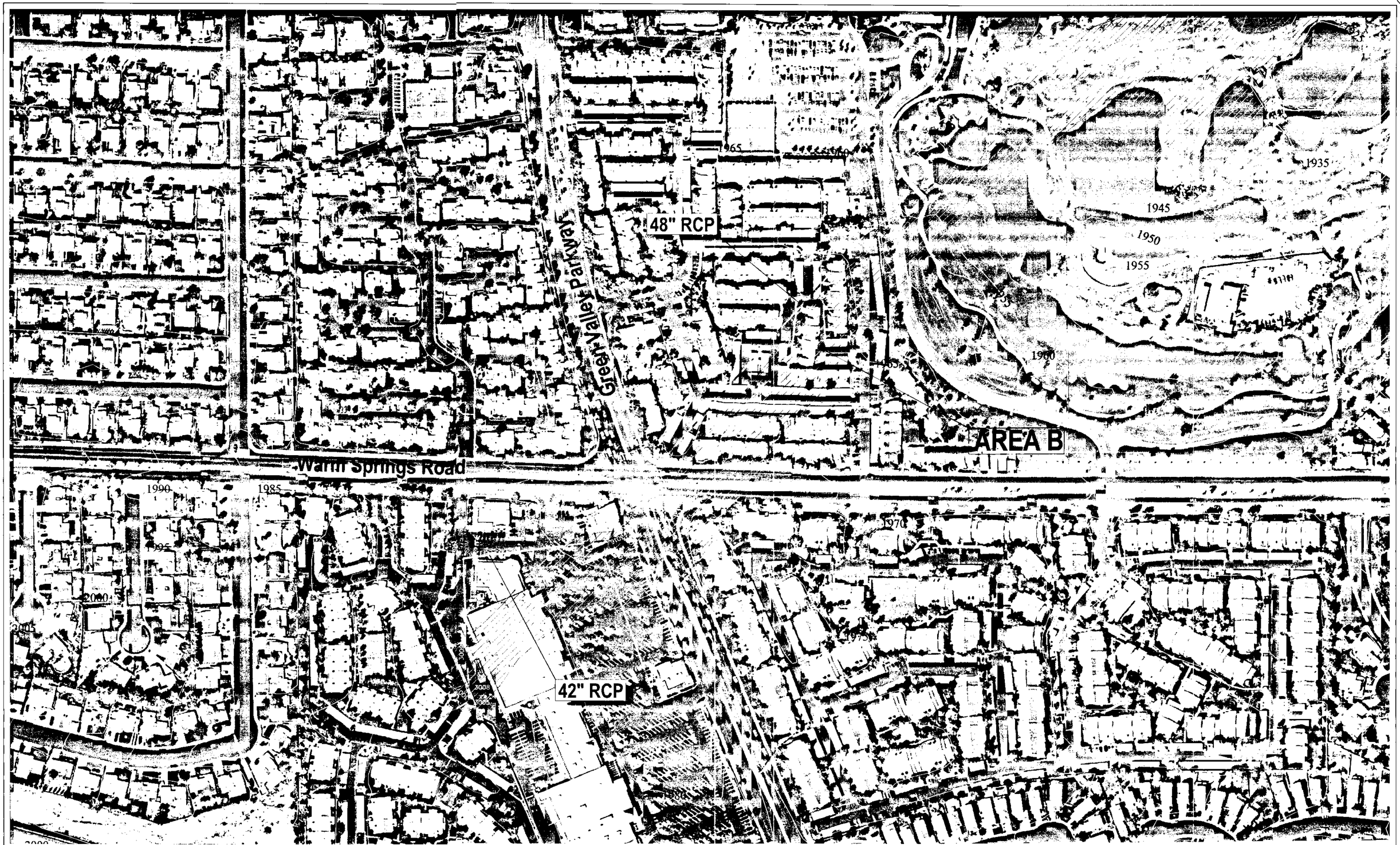


FIGURE 2B: Storm Drain Survey Figure

Green Valley Area LOMR

Project No. 511542.00 July 2004

Legend

Existing Storm Drain Facility

\+ Survey Data Point, please refer to Appendix C for elevation and description listings

I herby certify that the survey data for the storm drain as shown on this figure is an accurate representation of the existing facility.

Matthew S. Baird, NV 13684 Date

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100ft.

PBSJ
2270 Corporate Circle
Suite 100 Henderson,
Nevada 89014
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING • PLANNING • SURVEYING • CONSTRUCTION SERVICES

FIGURE 2B

SUPPLEMENT TO THE RESPONSE TO COMMENTS TO THE GREEN VALLEY AREA REQUEST FOR LETTER OF MAP REVISION

Case No.: 04-09-0954P
Community: City of Henderson, Nevada
Community No.: 320005

Prepared for:

Clark County Regional Flood Control District
500 South Grand Central Parkway
Las Vegas, NV 89155

Prepared by:

PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

Reference Number: 511542.00
September 1, 2004

PBS&J

ENGINEERING · PLANNING
CONSTRUCTION SERVICES
SURVEYING

RFCD

2004 SEP -1 PM 2:53

September 1, 2004

Ms. Sheila M. Norlin
National LOMC Manager
Michael Baker Jr., Inc.
3601 Eisenhower Avenue
Alexandria, Virginia 22304-6425

RE: CASE NO.: 04-09-0954P
COMMUNITY: CITY OF HENDERSON, NV
COMMUNITY NO.: 320005

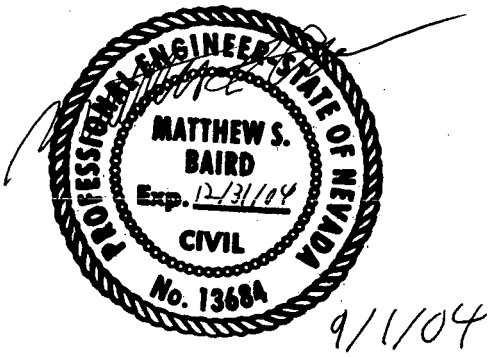
Dear Ms. Norlin:

Submitted for your review is the Supplement to the Response to Comments for the Green Valley Area Request for Letter of Map Revision.

If you have any questions regarding this report, please contact our office at (702) 263-7275.

Sincerely,

PBS&J



9/1/04

Brian K. Loffman, CFM
Hydrologist

Matt Baird, P.E., CFM
Senior Program Manager

2270 Corporate Circle · Suite 100 · Henderson, Nevada 89074-6382 · Telephone 702/263-7275 · Fax 702/263-7200

This supplement is based on a telephone conversation between PBS&J and Michael Baker Jr, Inc. on August 24, 2004 and the email correspondence from Kevin Eubanks of the Clark County Regional Flood Control District in which the formal storm drain analysis from PBS&J was requested (see Appendix A).

Presented below are the results of the normal depth analysis on the storm drain system for Area B. As discussed in the response to comments (Case No. 04-09-0954P), the storm drain system is between 17 and 20 years old. As a result, as-built plans were not readily available and PBS&J performed survey for the certification of the system in lieu of as-built plans. PBS&J then used the survey data (inverts) to calculate slopes for the four major segments of the storm drain. However, due to the lack of as-built plans, the exact alignment of the storm drain system is unknown. Slopes were calculated based on invert data obtained at the major angle points. Therefore, to account for any uncertainty in slopes and/or pipe lengths, a rating curve for each of the cross-sections was prepared to show adequate capacity above and below the calculated slope.

The location of the cross-sections discussed below are based on the four major segments of the storm drain, please refer to the Cross-Section Location Map in Appendix B.

Also, refer to Appendix C for the Flowmaster calculation worksheets.

Cross-Section A-A (between inlet and first angle point)
Achieve
42" RCP - calculated slope = 0.78%, Q=25 cfs
Q = total flow tributary to storm drain inlet from Area A analysis
Normal Depth = 1.27'
Rating Curve shows a normal depth of approximately 2.8' at a minimum slope of 0.1%

Cross-Section B-B (between first and second angle point)

42" RCP - calculated slope = 1.9%, Q=47 cfs
Q = 25 + drop inlet collection (22) = 47 cfs
Normal Depth = 1.4'
Rating Curve shows a normal depth of approximately 3' at a minimum slope of 0.2%

Cross-Section C-C (between second and third angle point)

42" RCP - calculated slope = 0.86%, Q=85 cfs
Q = 47 + drop inlet collection (38) = 85 cfs
Normal Depth = 2.62'
Rating Curve shows a full flow normal depth capacity at a slope of approximately 0.65%

Cross-Section D-D (between intersection of GVP and Warm Springs and outlet)

48" RCP - calculated slope = 0.83%, Q=133 cfs
Q = 85 + basin EX7B (48) = 133 cfs (see note below)
Normal Depth = 3.34'

Rating Curve shows a full flow normal depth capacity at a slope of 0.75%*

It should be noted that the 42"/48" storm drain was originally sized to accommodate more flow than the area that is currently tributary. This is due to the construction of the UPRR channel approximately 300' south of the storm drain inlet. The UPRR channel cuts off the majority of the upstream tributary watershed south of the floodzone (as discussed in the original LOMR submittal).

*It should also be noted that the flow used in Section D-D represents the most conservative approach. The entire 100-year flow from basin EX7B (48 cfs) was added to the storm drain for analysis. The apartment complex that comprises basin EX7B has two nuisance drop inlets that would capture significantly less than the 48 cfs. The majority of the flow from basin EX7B is surface discharged to the golf course.

The above results show that the storm drain system for Area B has sufficient capacity to accommodate the 100-year flow and thus a detailed WSPG analysis does not appear to be warranted.

Appendix A: Email Correspondence

Loffman, Brian

From: Kevin Eubanks [KEubanks@ccrfcd.org]
Sent: Tuesday, August 31, 2004 10:31 AM
To: Baird, Matt; Loffman, Brian
Subject: FW: FW: Green Valley Area LOMR (Case No.04-09-0954P)

Package up your analysis for submittal. See below.

Thanks

Kevin Eubanks, P.E., CFM
Assistant General Manager
Clark County Regional Flood Control District
600 Grand Central Parkway
Las Vegas, Nevada 89106-4511
702.455.3139
KEubanks@ccrfcd.org
Website: www.ccrfcd.org

-----Original Message-----
From: Sacha Tohme [mailto:STohme@mbakercorp.com]
Sent: Tuesday, August 31, 2004 10:15 AM
To: Kevin Eubanks
Cc: Erin Cummings
Subject: Re: FW: Green Valley Area LOMR (Case No.04-09-0954P)

Kevin,

We are going to conduct the analysis over here and compare the results with those from PBS&J. I suppose the normal depth calculations were performed using Flowmaster or a similar software. We would need all backup calculations and input/output that PBS&J used to perform this analysis. I think the best way would be that analysis be formalized, stamped, and mailed just like you suggested. We will let you know about our results.

Sacha Tohme, CFM
Revisions Manager - Region IX (NV)
Michael Baker Jr. Inc.
3601 Eisenhower Avenue
Alexandria, VA 22304
TEL: 703-960-8800 x 3028
FAX: 703-960-9125

>>> "Kevin Eubanks" <KEubanks@ccrfcd.org> 8/31/2004 10:58:41 AM >>>
Sacha,

We were recently given reason to believe that this request was all but ready to be forwarded to FEMA for approval. Last week PBS&J said you and your staff might need a WSPG model for the storm drain in Area B. I
am certainly ready to prepare and submit anything you guys need to get the job done. I also have to keep an eye on my budget. A WSPG model at this point would be a major undertaking relative to my budget. So I had PBS&J prepare the attached analysis to see if that would address your concerns. What it shows is that for the given flows, the pipes convey them without pressurizing the system. Therefore, what gets into the system will stay in the system. The detail offered by a WSPG run given this analysis and the amount of flow we are talking about may not be warranted. But then, that is your call. If I can avoid preparing a WSPG model based on the attached analysis, I would like to. If you need this analysis formalized, stamped and mailed just let me know.

Kevin Eubanks, P.E., CFM
Assistant General Manager
Clark County Regional Flood Control District
600 Grand Central Parkway
Las Vegas, Nevada 89106-4511
702.455.3139
KEubanks@ccrfcd.org
Website: www.ccrfcd.org
-----Original Message-----
From: Loffman, Brian [mailto:BLoffman@pbsj.com]
Sent: Monday, August 30, 2004 3:25 PM
To: Kevin Eubanks
Cc: Matt Baird
Subject: Green Valley Area LOMR (Case No.04-09-0954P)

Kevin,
Presented below are the results of the normal depth analysis on the storm drain system for Area B. As discussed in the response to comments (Case No. 04-09-0954P), the storm drain system is between 17 and 20 years old. As a result, as-built plans were not readily available and PBS&J performed survey for the certification of the system in lieu of as-built plans. PBS&J then used the survey data (inverts) to calculate slopes for the four major segments of the storm drain. However, due to the lack of as-built plans, the exact alignment of the storm drain system is unknown. Slopes were calculated based on invert data obtained at the major angle points. Therefore, to account for any uncertainty in slopes and/or pipe lengths, a rating table for each of the cross-sections was prepared to show adequate capacity above and below the calculated slope.

The location of the cross-sections discussed below are based on the four major segments of the storm drain, please refer to the Survey Figure presented in the Response to Comments for the storm drain layout.

Cross-Section A-A (between inlet and first angle point)

42" RCP - calculated slope = 0.78%, Q=25 cfs
Q = total flow tributary to storm drain inlet from Area A analysis
Normal Depth = 1.27'
Rating Table shows a normal depth of 2.8' at a minimum slope of 0.1%

Cross-Section B-B (between first and second angle point)

42" RCP - calculated slope = 1.9%, Q=47 cfs
Q = 25 + drop inlet collection (22) = 47 cfs
Normal Depth = 1.4'
Rating Table shows a normal depth of 2.4' at a minimum slope of 0.5%

Cross-Section C-C (between second and third angle point)

42" RCP - calculated slope = 0.86%, Q=85 cfs
Q = 47 + drop inlet collection (38) = 85 cfs
Normal Depth = 2.62'
Rating Table shows a normal depth capacity down to a slope of 0.7%

Cross-Section D-D (between intersection of GVP and Warm Springs and outlet)

48" RCP - calculated slope = 0.83%, Q=133 cfs
Q = 85 + basin EX7B (48) = 133 cfs (see note below)
Normal Depth = 3.34'
Rating Table shows a normal depth capacity down to a slope of 0.75%

It should be noted that the 42"/48" storm drain was originally sized to accommodate more flow than the area that is currently tributary. This is due to the construction of the UPRR channel approximately 300' south of the storm drain inlet. The UPRR channel cuts off the majority of the upstream tributary watershed south of the floodzone (as discussed in the original LOMR submittal).

It should also be noted that the flow used in Section D-D represents the most conservative approach. The entire 100-year flow from basin EX7B (48 cfs) was added to the storm drain for analysis. The apartment complex that comprises basin EX7B has two nuisance drop inlets that would capture significantly less than the 48 cfs. The majority of the flow from basin EX7B is surface discharged to the golf course.

The above results show that the storm drain system for Area B has sufficient capacity to accommodate the 100-year flow.

Appendix B: Cross-Section Figure

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

1 inch = 200 ft.

FIGURE B: CROSS-SECTION LOCATION MAP

A Cross-Section

+ Survey Data Point

Floodzone

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada
89074
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE B

Appendix C: Normal Depth Calculations

Worksheet for Section A-A

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	*Normal Depth*	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.78000	%
Diameter:	42.00	*in*
Discharge:	25.00	ft^3/s
Results		
Normal Depth:	1.27	ft
Flow Area:	3.15	ft^2
Wetted Perimeter:	4.53	ft
Top Width:	3.37	ft
Critical Depth:	1.54	ft
Percent Full:	36.3	%
Critical Slope:	0.00387	ft/ft
Velocity:	7.93	ft/s
Velocity Head:	0.98	ft
Specific Energy:	2.25	ft
Froude Number:	1.45	
Maximum Discharge:	95.58	ft^3/s
Discharge Full:	88.85	ft^3/s
Slope Full:	0.00062	ft/ft
Flow Type:	*SuperCritical*	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	0.00	%
Downstream Velocity:	0.00	ft/s

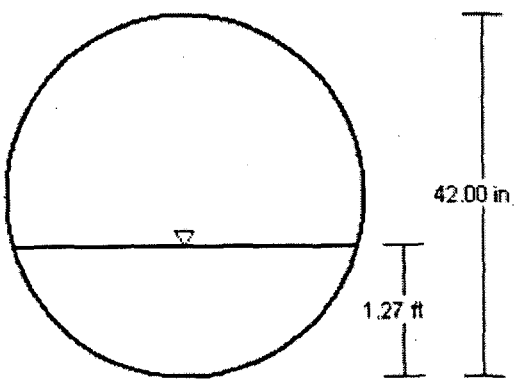
Worksheet for Section A-A

Upstream Velocity:	0.00	ft/s
Normal Depth:	1.27	ft
Critical Depth:	1.54	ft
Channel Slope:	0.78000	%
Critical Slope:	0.00387	ft/ft

Section A-A
Cross Section for Section A-A

Project Description	
Flow Element:	*Circular Pipe*
Friction Method:	Manning Formula
Solve For:	Normal Depth

Section Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.78000	%
Normal Depth:	1.27	ft
Diameter:	42.00	in
Discharge:	25.00	ft³/s



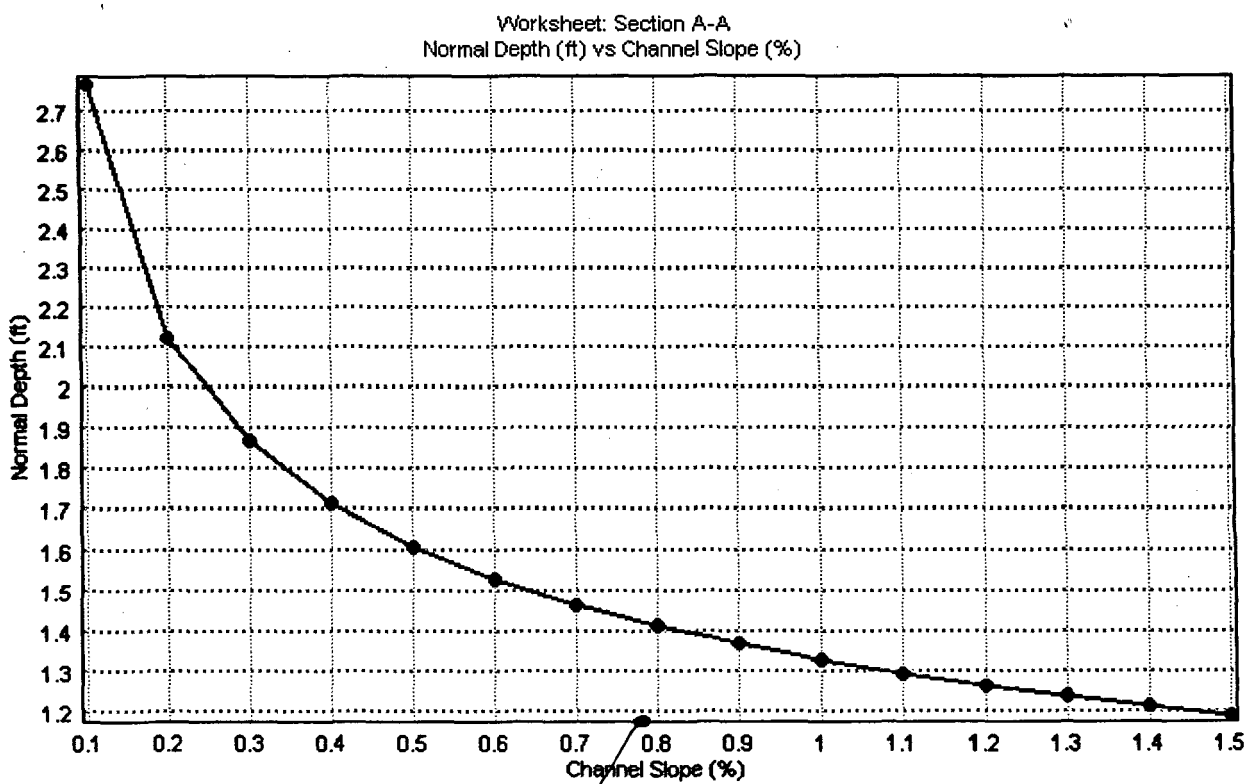
V: 1
H: 1

Rating Curve for Section A-A

Project Description	
Flow Element:	Circular Pipe
Friction Method:	Manning Formula
Solve For:	Normal Depth

Input Data		
Channel Slope:	0.50000	%
Diameter:	42.00	in
Discharge:	25.00	ft³/s

Attribute	Minimum	Maximum	Increment
Channel Slope (%)	0.10000	1.50000	0.10000



Calculated slope based on survey data is 0.78%

Worksheet for Section B-B

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	1.90000	%
Diameter:	42.00	in
Discharge:	47.00	ft^3/s

Results		
Normal Depth:	1.40	ft
Flow Area:	3.61	ft^2
Wetted Perimeter:	4.80	ft
Top Width:	3.43	ft
Critical Depth:	2.14	ft
Percent Full:	40.1	%
Critical Slope:	0.00456	ft/ft
Velocity:	13.02	ft/s
Velocity Head:	2.64	ft
Specific Energy:	4.04	ft
Froude Number:	2.24	
Maximum Discharge:	149.17	ft^3/s
Discharge Full:	138.67	ft^3/s
Slope Full:	0.00218	ft/ft
Flow Type:	SuperCritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	0.00	%
Downstream Velocity:	0.00	ft/s

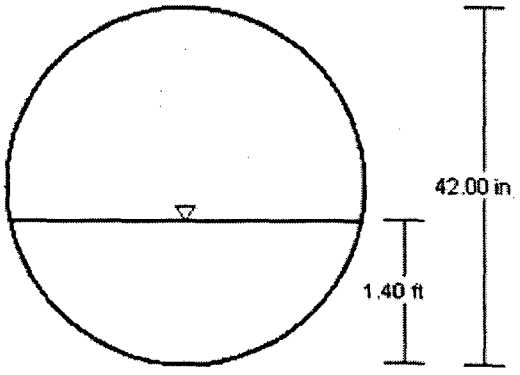
Worksheet for Section B-B

Upstream Velocity:	0.00	ft/s
Normal Depth:	1.40	ft
Critical Depth:	2.14	ft
Channel Slope:	1.90000	%
Critical Slope:	0.00456	ft/ft

Section B-B
Cross Section for Section B-B

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data		
Roughness Coefficient:	0.013	
Channel Slope:	1.90000	%
Normal Depth:	1.40	ft
Diameter:	42.00	in
Discharge:	47.00	ft³/s



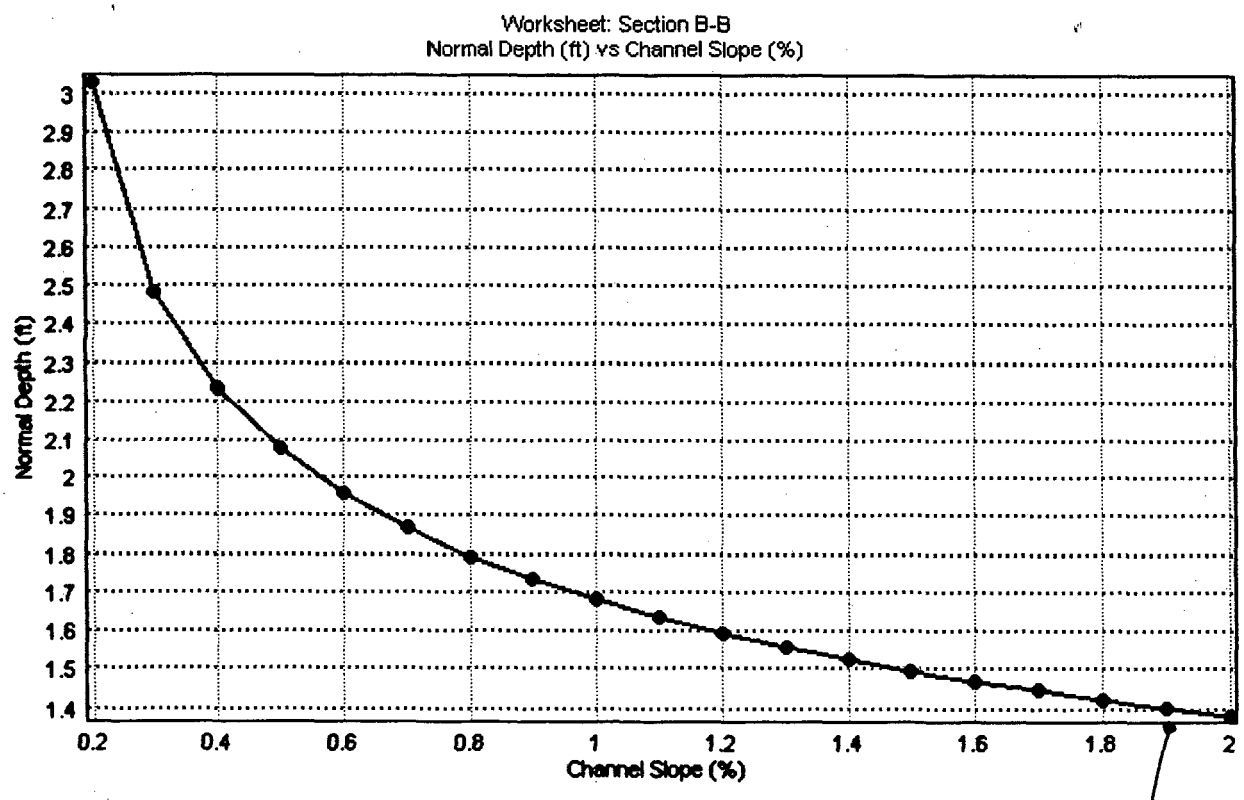
V: 1
H: 1

Rating Curve for Section B-B

Project Description	
Flow Element:	Circular Pipe
Friction Method:	Manning Formula
Solve For:	Normal Depth

Input Data		
Channel Slope:	1.90000	%
Diameter:	42.00	in
Discharge:	47.00	ft³/s

Attribute	Minimum	Maximum	Increment
Channel Slope (%)	0.10000	2.00000	0.10000



Calculated slope based on Survey data is 1.9%

Worksheet for Section C-C

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.86000	%
Diameter:	42.00	in
Discharge:	85.00	ft^3/s

Results		
Normal Depth:	2.62	ft
Flow Area:	7.73	ft^2
Wetted Perimeter:	7.33	ft
Top Width:	3.03	ft
Critical Depth:	2.87	ft
Percent Full:	74.9	%
Critical Slope:	0.00712	ft/ft
Velocity:	10.99	ft/s
Velocity Head:	1.88	ft
Specific Energy:	4.50	ft
Froude Number:	1.21	
Maximum Discharge:	100.36	ft^3/s
Discharge Full:	93.30	ft^3/s
Slope Full:	0.00714	ft/ft
Flow Type:	SuperCritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	0.00	%
Downstream Velocity:	0.00	ft/s

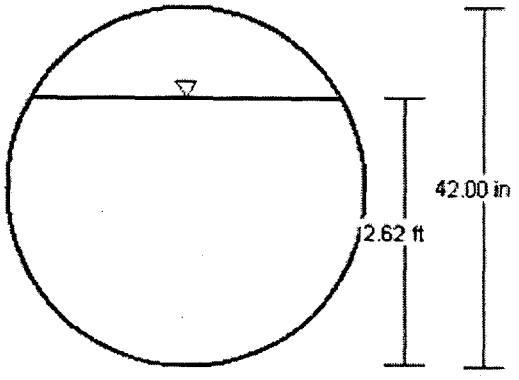
Worksheet for Section C-C

Upstream Velocity:	0.00	ft/s
Normal Depth:	2.62	ft
Critical Depth:	2.87	ft
Channel Slope:	0.86000	%
Critical Slope:	0.00712	ft/ft

Section C-C
Cross Section for Section C-C

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.86000	%
Normal Depth:	2.62	ft
Diameter:	42.00	in
Discharge:	85.00	ft³/s



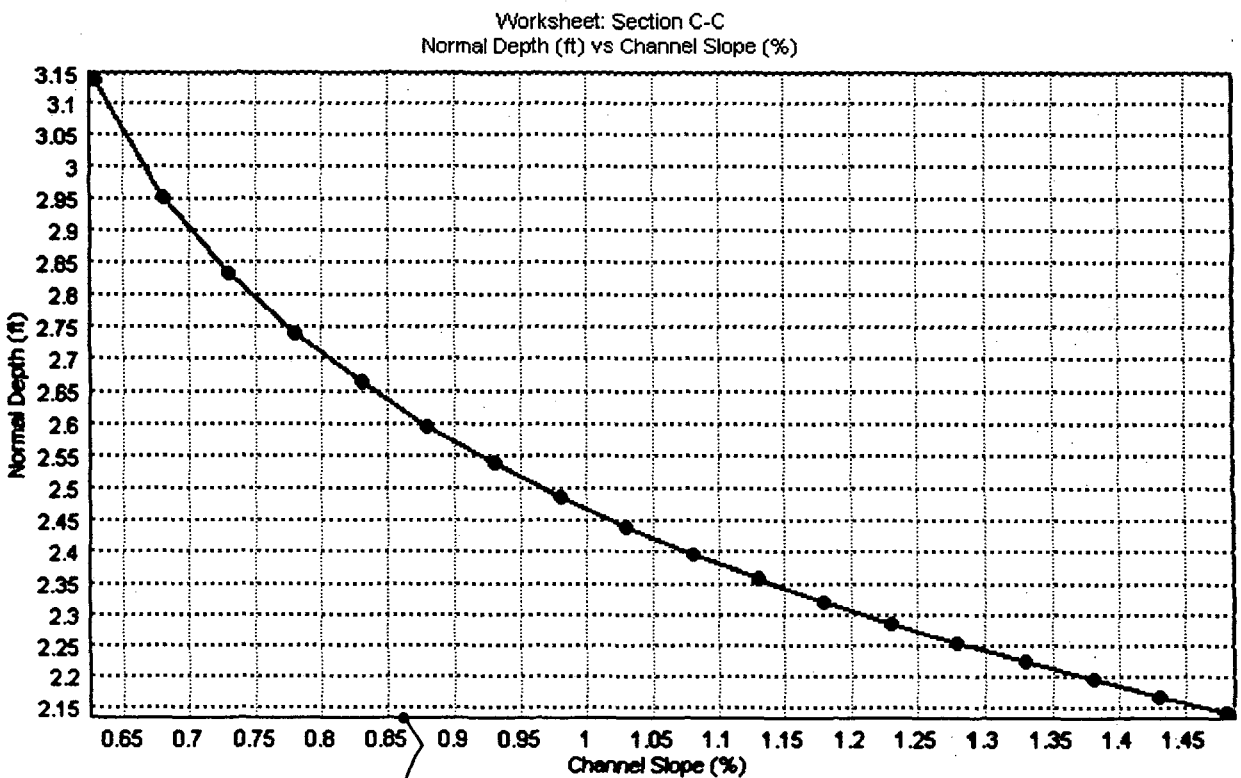
V: 1
H: 1

Rating Curve for Section C-C

Project Description	
Flow Element:	Circular Pipe
Friction Method:	Manning Formula
Solve For:	Normal Depth

Input Data		
Channel Slope:	0.63000	%
Diameter:	42.00	in
Discharge:	85.00	ft³/s

Attribute	Minimum	Maximum	Increment
Channel Slope (%)	0.63000	1.50000	0.05000



Calculated slope based on Survey data is 0.86%

Worksheet for Section D-D

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.83000	%
Diameter:	48.00	in
Discharge:	133.00	ft^3/s

Results		
Normal Depth:	3.34	ft
Flow Area:	11.21	ft^2
Wetted Perimeter:	9.22	ft
Top Width:	2.97	ft
Critical Depth:	3.44	ft
Percent Full:	83.5	%
Critical Slope:	0.00793	ft/ft
Velocity:	11.86	ft/s
Velocity Head:	2.19	ft
Specific Energy:	5.53	ft
Froude Number:	1.08	
Maximum Discharge:	140.76	ft^3/s
Discharge Full:	130.86	ft^3/s
Slope Full:	0.00857	ft/ft
Flow Type:	SuperCritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	0.00	%
Downstream Velocity:	0.00	ft/s

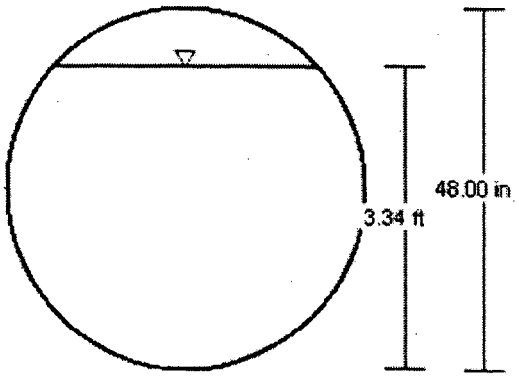
Worksheet for Section D-D

Upstream Velocity:	0.00	ft/s
Normal Depth:	3.34	ft
Critical Depth:	3.44	ft
Channel Slope:	0.83000	%
Critical Slope:	0.00793	ft/ft

Section D-D
Cross Section for Section D-D

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.83000	%
Normal Depth:	3.34	ft
Diameter:	48.00	in
Discharge:	133.00	ft^3/s



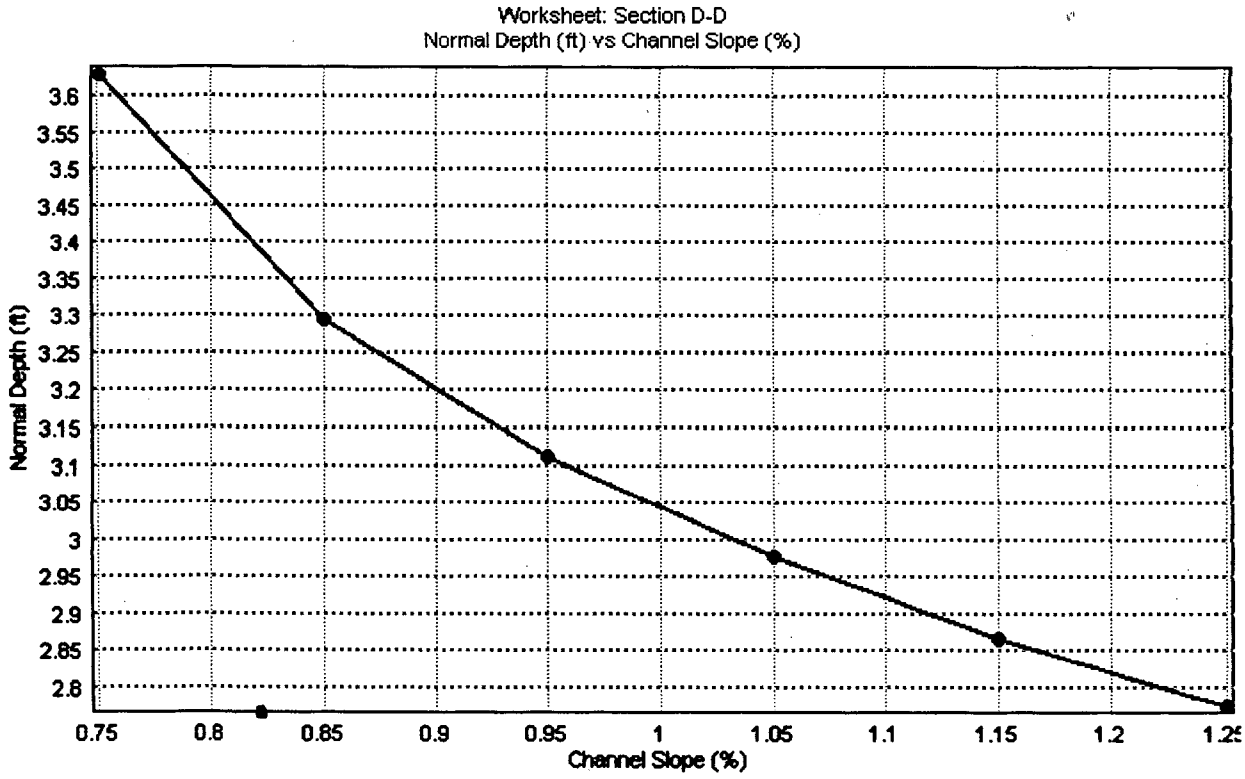
V: 1
H: 1

Rating Curve for Section D-D

Project Description	
Flow Element:	Circular Pipe
Friction Method:	Manning Formula
Solve For:	Normal Depth

Input Data		
Channel Slope:	0.83000	%
Diameter:	48.00	in
Discharge:	133.00	ft³/s

Attribute	Minimum	Maximum	Increment
Channel Slope (%)	0.75000	1.30000	0.10000



Calculated slope based on Survey data is 0.83%

PBS&J

RFCD

2004 SEP -1 PM 2:53

LETTER OF TRANSMITTAL

Date September 1, 2004

Job No: 511542.00
Project Name: Green Valley Area
LOMR Response to Comments

TO: Kevin Eubanks, P.E.
Clark County Regional Flood Control District
600 South Grand Central Parkway, Suite 300
Las Vegas, Nevada 89106

FROM: Brian K. Loffman
2270 Corporate Circle
Suite 100
Henderson, NV 89074

Transmitted:

- ☐ Herewith
- ☒ Via Carrier
- ☐ Signature

For:

- ☐ Approval
- ☐ Checking
- ☒ Your Use
- ☐ Information
- ☐ Return after Use
- ☐ As Requested

The Following:

Kevin, here is a copy of the supplement to the response to comments on the Green Valley Area LOMR. This was forwarded to Michael Baker on Sept 1, 2004.

Comments:

This copy is for you to keep.

Received by: _____ Date _____

Signed by: Brian K. Loffman

2270 Corporate Circle, Suite 100 Henderson, Nevada 89074 Telephone :(702) 263-7275 Fax : (702) 263-7200